ELECTRICAL REVIEW

29th FEBRUARY 1952

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Purpose of the Convention

IT is evident from what we hear and read that a great many people are still unaware of the nature and purpose of the British Electrical Power Convention. First, as to its nature, it is necessary to repeat what we have said so often before that the Convention is not a purely electricity supply function. The British Electricity Authority and Electricity Boards are only partners with other electrical organizations; they have six representatives (or seven if the E.D.A. representative is included) on the Convention Council, against sixteen (or fifteen) from other branches of the electrical industry. Manufacturers' associations have five and electrical contractors two; other sections have one representative each.

The primary purpose of the Convention is to provide opportunities for members of all the associations represented to meet one another socially and to join in business sessions in which views can be exchanged; both aspects are calculated to promote closer working and harmonious relations between the interdependent branches. On the business side the individual branches can acquaint the rest with developments in their spheres. The general idea is to deal with various aspects of the provision and application of electricity in order to improve understanding and efficiency.

A short time ago the Convention was discussed at a meeting of the electricity supply industry's Employees' National Committee. It is questionable, of course, whether this sectional committee is competent to deal with the matter at all, but it was decided to approach the chairman of the B.E.A. to discuss "informally" proposed changes for the improvement of the Convention. The "improvements" suggested were of a nature which would have turned the affair into a sort of trade union congress, as one or two speakers pointed out. It seemed to be the general opinion that because workers claimed to have a say in the management of the industry they should be represented at the Convention in strength.

But at least one member of the Committee realized that this would alter the basic idea of the Convention.

Such misunderstanding is not exclusive to the trade unions; many members of the industry actually represented, through their associations, in the Council and at the Convention are still unaware of the purpose of the gathering and are sceptical about its usefulness. We have done our best to secure the continuance of the Convention, believing it to be necessary. We would like to see our efforts backed up by a brief, clear statement from the Council, to be circulated throughout the industry or, at least, reproduced in the official journals of the participating associations.

INDUSTRIAL ACCIDENTS

Since the proportion of accidents in industry caused by electricity is less than 0·5 per cent, an aspect commented on in his report by the Chief Inspector of Factories, it is not surprising that few direct references are made to it in the two guides to statutory requirements published by the Royal Society for the Prevention of Accidents and reviewed in this issue. The wide use of portable electrical apparatus and flexible cables in building work, often in dangerous situations and in temporary installations, accounts for nearly one-third of all reportable electrical accidents, but shock risks from this cause would be rendered negligible by transformation to 110 V (64 V to earth).

NOT ELECTRICTY

For years it has been customary for investigators of the causes of fires, when all evidence has been destroyed, to blame them upon "the fusing of an electric wire." This has continued in spite of repeated protests by the Electrical Development Association and ourselves. It is therefore gratifying to us to read the report of the Chief Officer of the London Fire Brigade (Mr. F. W. Delve) upon a London warehouse fire in December last in which it is very clearly stated: "The good electrical arrangements in the building rule out an electrical cause." Mr. Delve deserves the industry's thanks for thus breaking away from a bad tradition.

CONTRIBUTIONS TO COSTS

One matter which is cropping up regularly nowadays is the question whether local authorities shall contribute to the cost of providing electricity supply to their housing estates. Electricity Boards, which have to operate on commercial lines, rightly contend that they cannot put in cable systems which are to be used merely for lighting and other small uses. They insist therefore that the authorities concerned shall help to defray the cost of the cables. The subject was discussed recently by the Falkirk Town Council which decided to accept liability for a contribution under the Electricity (Supply) Act, 1899, but to retain the money in a suspense account until an appeal had been heard and disposed of. It was said that representatives of the Electricity Board had expressed a hope that a uniform policy would be adopted throughout the country in the near future.

AMERICAN PLANT CAPACITY

As in this country, but not altogether for the same reasons, the United States electricity supply industry got through its peak month, December, without trouble—indeed it had a margin of 11·5 per cent between the highest demand and available plant capacity. The Edison Electric Institute attributes this success to the non-materialization of threatened increases in the "defense" load; the falling-off of industrial production for civilian purposes; unexpected diversity in peak demands in various regions; and the excellence of water conditions for hydro-electric plant.

NEW FLOUR MILLS

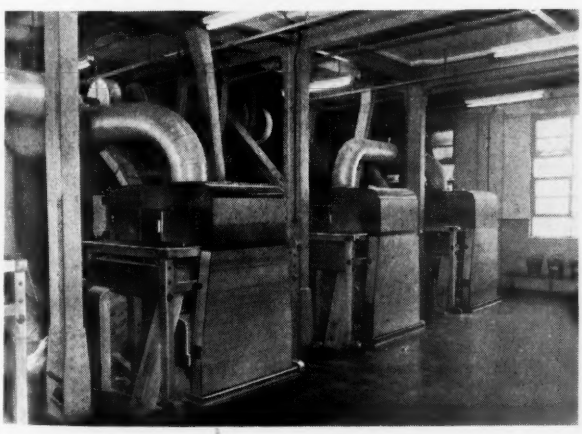
Electrical Installation at the Latest Joseph Rank Establishment at Gateshead

Mobile suction plant unloading grain

ONE of the latest additions to the group of flour mills operated by Joseph Rank, Ltd., is the largest single plant yet constructed by the company. Situated at Gateshead, this entirely new building, now in full production, has a milling capacity of 80 sacks an hour, compared with 60 sacks an hour output from each of the two plants installed at the company's rebuilt Southampton mills described in the *Electrical Review* of 23rd March, 1951.

In general, the installation follows much the same lines as that at Southampton. Grain is brought to the mills by boat up the Tyne and unloaded at the adjacent quayside by means of two Spencer (Melksham) 120 tons/hour traversing suction plants, each of these incorporating an Electric Construction Co.'s 150 h.p. 440 V 580 r.p.m. slip ring induction motor controlled by an E.C.C. starter. Interlocked with these suction motors are receivers and rotating valves driven by 7½ h.p. 958 r.p.m. motors. Both the traversing gear (15 h.p. motors) and the winches (5 h.p. motors) for raising the booms, telescopic pipes, etc., are fitted with Ellison limit switches and are remote controlled from the drivers' cabins, Allen West starters and regulators being provided for both the traversing gear and also the winches.

In the cleaning process "Eureka" separators remove impurities larger than wheat



Belling gilled wall radiators are used to warm the cabins and a 110 V supply is provided from a small transformer (Foster Transformers & Switchgear, Ltd.) for lighting purposes.

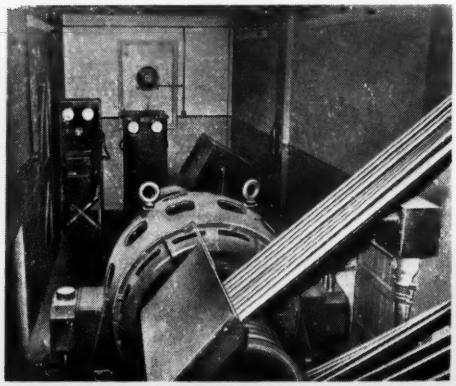
From the suction plants the grain is discharged on to conveyors (12 h.p.

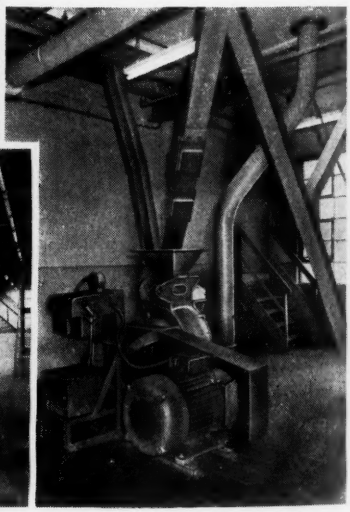
motors) running in a tunnel under the full length of the quay. Further conveyors at right angles carry the grain to elevators (25 h.p. motors) in the receiving house where it is given a preliminary cleaning and is automatically weighed before transfer to bins in a silo having a storage capacity of 25,000 tons. A system of belt and screw conveyors (6 h.p. motors) on the top and bottom floors of the building, besides permitting the grain to be turned over periodically to prevent heating, can also be used to mix the grain preparatory to cleaning.

Cleaning is carried out in a five-storey building in which the whole of the treatment plants are driven by a single Mather & Platt 200 h.p. synchronous motor equipped with Brush switchgear and liquid starter. Transfer from one process to another is effected wherever possible by gravity supplemented by elevators and worm conveyors, the grain being untouched by hand throughout.

In this building, Cyclo Pneumatic machines remove the dust, washing plants eliminate stones by gravity and ferrous material is removed by means of permanent magnets. In the same room are "Eureka" separators which remove impurities larger than wheat and also dust and small seeds by means of reciprocating sieves. Barley, oats and also small seeds are removed by Carter disc separators on the third floor where the dryer associated with the washing plant is situated. Further disc separators are provided on the second floor on which has also been installed apparatus for recovering solids from the washing plant effluents. Fans required to produce currents of cold air for drying purposes are installed on the first floor together with further separating plant and a Barron "Impact" mill (30 h.p. motor) for grinding up refuse from the cleaning plant for use as animal feeding stuffs.

After spending a few hours in the



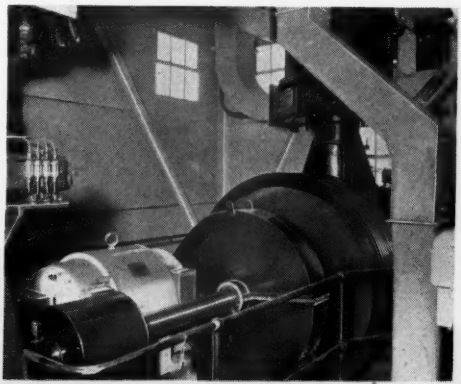


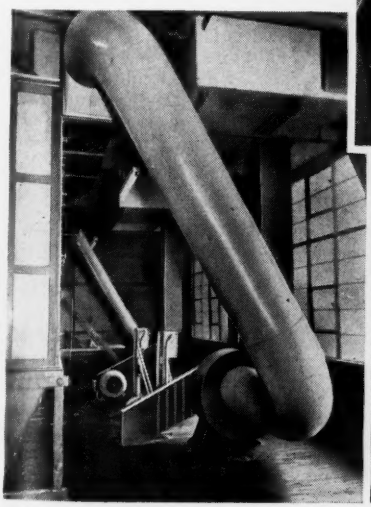
Left: **The whole of the cleaning plant is operated by a Mather & Platt 200 h.p. motor equipped with Brush switch, controller and liquid starter.** *Bottom left:* **A row of purifiers.** *Below:* **A Barron "Impact" mill driven by a 30 h.p. motor grinds up refuse from the cleaning plant for use as animal feeding stuffs**

conditioning bins, the cleaned grain goes to storage hoppers (180 ton total capacity) to await milling. This is also undertaken in a five storey building, the plant of which is arranged as follows: nine dust extraction fans (two 12 h.p., two 14 h.p., four 20 h.p. and one 10 h.p.) on the top floor; 108 fine silk flour dressing machines and weighing machines on the fourth floor; 24 scalpers and 14 purifiers on the third floor; 14 purifiers and 36 4-roller mills on the second floor; and 72 4-roller mills on the first floor. To obtain the stipulated 81 per cent reduction the mill is laid out to give five separate breaks and thirteen reductions.

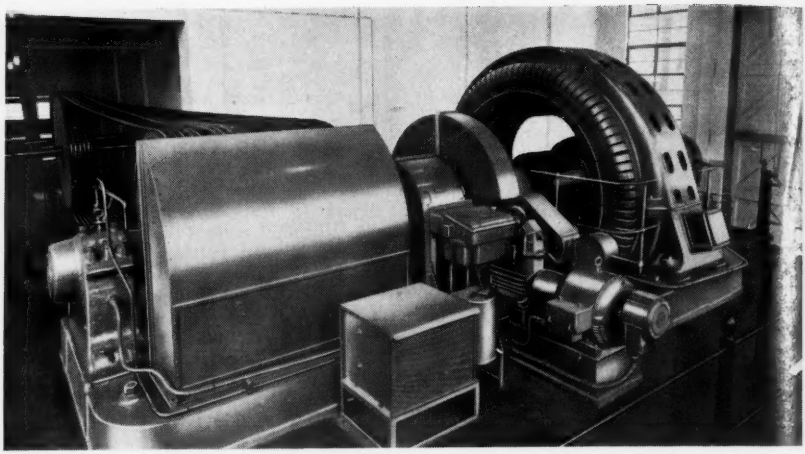
In accordance with the company's normal policy, the whole of the mill plant is driven by a single motor. This is a 900 b.h.p. 5,500/5,600 V synchronous induction unit of the open protected type, running at 250 r.p.m. It has five pedestal bearings of the oil ring and pressure lubricated type and is direct coupled to a 31 V, 470 A exciter. Between the second and third bearings is a flexible coupling with barring gear (13½ h.p. motor) giving a rotor speed of 1.4 r.p.m. for starting purposes. In view of the exceptionally heavy starting conditions, the liquid starter is designed to start up the motor against 2½ times full load torque. The complete unit, which is designed to run at 0·7 leading power factor, is mounted on a cast iron bedplate. A shaft extension between the third and fourth bearing is fitted with a rope pulley grooved for 23 1¾in cotton ropes.

The milling operations complete, the flour is stored in bulk in a warehouse, the bins and plant being of sufficient capacity to enable the whole twenty-four hours' production of the mill to be dealt with in eight hours. Before bagging the flour is sieved, mixed and weighed automatically and various handling facilities are provided in the way of hoists, elevators and conveyors.

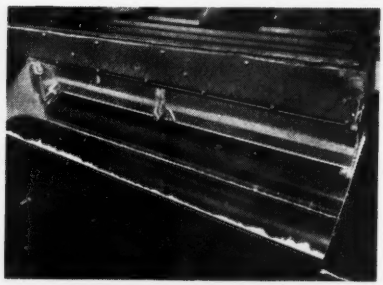




Right: **Interior of mobile suction plant showing E.C.C. 150 h.p. slip ring induction motor driving one of the pumps: the receivers and rotating valves are interlocked with this motor.** *Below:* **Dust extraction plant at the top of the mill building comprises nine fans.** *Bottom right:* **Some of the 4-roller mills**



This E.C.C. 900 b.h.p. 5,500/5,600 V motor drives all the milling plant through the rope drive. The barring gear motor is to be seen on the right



An automatic machine (Brecknell Munro and Rogers) enables four girls to fill, seal and pack twenty-seven 3 lb bags of flour a minute. Other electrically driven apparatus is utilized for cleaning, repairing and printing sacks. Between the mill and the warehouse is a small self-contained provender and flaking mill.

Two 600 kVA 5·6 kV/440 V three-phase transformers have been installed in the mill motor house to provide supplies for the smaller motors, lighting, etc., and space has been provided for a third unit if and when required. The six panel h.v. switchboard incorporates five circuit breakers of 150 MVA rupturing capacity covering these transformers, as well as the incoming supply and the mill motor, and a metering panel. At present the maximum demand recorded is 1,450 kVA, the plant totalling approximately 3,000 connected h.p.

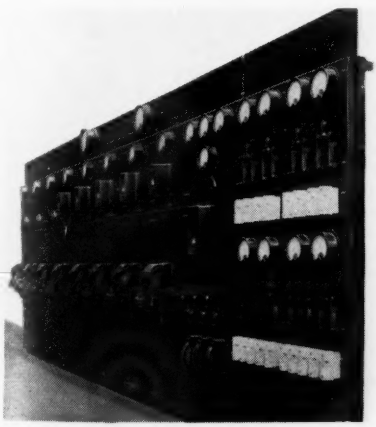
The l.v. switchboard incorporates panels for the incoming supplies from the transformers and outgoing supplies to the mill, the riverside intake plant, the warehouse, provender mill and flaking plant, cleaning plant, silo and receiving house, and main and two subsidiary lighting groups. Both h.v. and l.v. switchgear, the transformers, the main mill motor and most of the smaller

Above left: **One of the 4-roller mills with cover raised to show rollers.** *Left:* **Sack printing machine.** *Right:* **Flat back semi-cubicle type low voltage switchboard**

Automatic machine enabling four girls to fill, seal and pack twenty-seven 3 lb bags of flour a minute and (right) sack cleaning plant

motors were supplied by the Electric Construction Co., Ltd., Wolverhampton.

The complete electrical installation was carried out by Joseph Rank's Electrical Department, Hull (chief electrical engineer: Mr. A. Smith). Allen West and E.C.C. motor starters have been employed almost exclusively, with separate switch-fuse isolators for each motor. Henley's wedge type cartridge fuses have been employed throughout the installation. Nearly one thousand Ekco-Ensign fluorescent fittings illuminate the building. Gent & Co., Ltd., supplied the fire alarm equipment. Henley's varnished cambric, lead sheathed and single wire armoured cable has been used for all power installations. V.i.r. in ¾in screwed conduit has been employed for lighting purposes, with copper sheathed "Pyrotenax" in certain positions.



Resistor Alloy

FURTHER information is now available about the nickel-chromium alloy of high resistivity with a low and stable temperature coefficient recently announced by the British Driver-Harris Co., Ltd. It has interesting possibilities in relation to resistor manufacture, having a resistivity of 800 ohms per circular mil-foot and a temperature coefficient of ± 0·00002 per deg C from minus 50 to 100 deg C.

The higher ohmic values of this "Karma" alloy make it possible for even smaller precision resistors to be wound at a still lower cost per ohm. Its stability permits wider applications at extended temperature ranges; its low thermal e.m.f., compared with that of copper-base alloys, is an assurance of accuracy; lesser tendency to oxidation prolongs its electrical properties; higher tensile strength permits faster winding speeds; and lower thermal expansion minimizes distortion and movement in windings. This alloy can be soldered, brazed or welded, and arrangements are being made to supply it conventionally insulated with enamel and fabric coverings. It is available in wire sizes down to 0·001in diameter.

Duty-Cycle Apparatus

Evaluation of Operating-Times and its Bearing on Machine Design

By J. R. HENDERSON,* M.B.E., B.SC.(ENG.)

A NEAT and convenient mathematical expression, which defines with sufficient accuracy the characteristic form of the speed-torque curve of standard squirrel-cage motors, was pointed out by Dr. T. F. Wall in the *Electrical Review* of 2nd February, 1951 (page 233). Using this he deduced a useful formula for acceleration and braking times for an induction motor with free shaft.

In many cases, however, no convenient formula is available. The purpose of this article is to indicate that graphical treatment may then be used, quickly and reliably, and without any tedious trial and error work. There is indeed something to be said for the use of the graphical method in *all* important or unusual cases. It provides a cross-check on any analytical work, and is a visual aid towards making the correct compromise between conflicting factors which is the basis of all good design.

Many electrically driven machines start and stop at infrequent intervals; for example, two or three times in twenty-four hours. A rough knowledge of their starting times is of value to the starter manufacturer, while the deceleration times are left to take care of themselves. But where the times required for starting and stopping take up an appreciable part of the period allowed for a complete cycle, as in the case of duty-cycle work, some estimate of these times must be made before machines are manufactured.

When acceleration is known to be constant, or a function of time, calculation is simple, but for most motors our basic knowledge is the torque characteristic (hence the acceleration) as a function of *speed*, and in any particular case we do not know directly how acceleration will vary with time. In mathematical terms, we have to solve the differential equation:—

$$\text{Torque} = f(\omega) = \frac{J}{9{\cdot}81}\frac{d\omega}{dt} \text{ kg.m.} \quad \ldots \quad (1)$$

where ω is angular velocity and J is moment of inertia.

Solving by integration we get

$$t = \frac{J}{9{\cdot}81}\int \frac{1}{f(\omega)}\,d\omega + C \quad \text{from which}$$

$$\left[t\right]_a^b = \frac{J}{9{\cdot}81}\int_a^b \frac{1}{f(\omega)}\,d\omega \quad \ldots \quad (2)$$

Induction motor torque is usually estimated as a function of slip, $f(s)$, and

$$s = \frac{\omega_0 - \omega}{\omega_0} \text{ where } \omega_0 \text{ is synchronous angular velocity.}$$

$$\frac{ds}{d\omega} = \frac{-1}{\omega_0} \text{ so } d\omega = -\omega_0 ds.$$

Writing equation (2) again in term of s,

$$\left[t\right]_{s=a}^{s=b} = -K\int_a^b \frac{1}{f(s)}\,ds \quad \ldots \quad (3)$$

where the constant K is $\frac{\omega_0 J}{9{\cdot}81}$ kg.m.sec.

The minus sign indicates that we should sum from right to left in the diagram and it should be noted that expression (1) is true only when by torque we mean the *net torque available for acceleration;* that is motor torque minus the torque absorbed by working load and friction. In machine-tool applications a motor may accelerate and/or reverse and accelerate with free shaft; "useful work" is done only at full speed. In lift or haulage work "useful work" is done all the time, during acceleration and braking as well as during the full-speed portion of the work cycle.

In general the curve of net torque

* G.E.C. Research Laboratories.

against speed will not be a simple mathematical expression. It may have discontinuities, for example, at zero speed, and analytical treatment becomes rather frightening. Graphical integration is simple, and the resulting diagram gives an overall picture of the starting and/or braking periods which can be very informative. The important things are to get the basic equations in the most suitable form (2) or (3), and to give careful attention to the units employed.

Referring to equation (2) the right-hand side in graphical terms means a constant multiplied by the sum (between the limits a and b) of elemental strips each $\frac{1}{f(\omega)}$ high by $\delta\omega$ wide (i.e., the area under the curve). For the constant $\frac{J}{9{\cdot}81}$ we choose units in (kg.m. sec^2). This divided by torque (kg.m.) gives (sec^2). If the ordinates in our diagram are measured in (sec)^2 and the abscissæ in radians/sec, the area under the curve represents time (1 sq cm = so many seconds).

In the numerical example which follows the procedure for the case of an induction motor is followed. The characteristic curves for an induction motor are usually worked out by assuming a series of values for the slip, s, and from then on, working out the corresponding values for torque, watts input and output, power factor, etc., either analytically or from a circle diagram. The same values for slip and torque serve for starting and braking times. It is useful to know the kind of answer to be expected so that we obtain the important points on the diagram with least labour. Work is best carried out in tabular fashion as in Table I.

TABLE I

Slip s	T/T_K	Net Torque to Acceleration kg.m.	K/F (s) secs.
0·1	0·385	0·1	1·6
0·15	0·55	0·6	0·267
0·2	0·69	1·02	0·157
0·3	0·883	1·6	0·1
0·5	1·0	1·95	0·082
0·7	0·945	1·78	0·09
1·0	0·8	1·35/3·45	0·118/0·0463
1·5	0·6	2·85	0·056
2·0	0·47	2·46	0·065

The example considers an induction motor with a full-load rating of 2 h.p., a synchronous speed of 1,500 r.p.m.

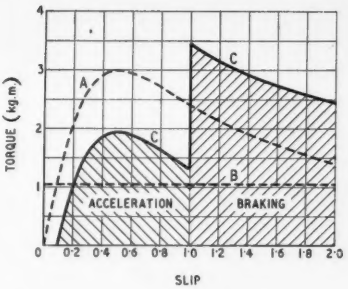


Fig. 1.—A=motor torque $T/T_K = 4s/(4s^2+1)$
B=load torque which is constant at 1·05 kg. m.
C=net torque to acceleration (A+B)

($\omega_0 = 157$ rad/sec), a full-load torque of 1·05 kg.m., and a maximum torque of 3·0 kg.m. (T_K). The slip at maximum torque $s = 0{\cdot}5$, motor torque $T/T_K = 4s/(4s^2+1)$, moment of inertia $J = 0{\cdot}01$ kg.m. and $K = \omega_0 J/9{\cdot}81 = 0{\cdot}16$ kg.m. sec.

It is assumed that the motor is solidly coupled to a constant torque load, and that during braking the load-torque is reversed and assists the motor braking torque. Fig. 1 makes the assumed conditions clear. It is required to find the time from the instant of "plugging" to approximate full-speed in the reverse direction.

The working-out follows as in Table I; nine values of slip have been chosen and are sufficient for this case. Fig. 2 is then drawn and the area under the curve estimated by planimeter, by counting squares, or by Simpson's Rule. (Note again that knowing the shape of things to come, we can select values of slip convenient for Simpson's Rule).

Once Fig. 2 is available we have all the data necessary to check the rotor heating. The maximum torque may be expressed as "synchronous watts" (3 kg.m. at 1,500 r.p.m. is equivalent to 4,630 synchronous watts). At any value of slip, s, the rotor loss is $\frac{T}{T_k}\, s$ (4,630) watts. The values are plotted against time in Fig. 3, the area under the watts curve giving watt-seconds. The average heating during reverse and start works out to about 2 kW, much too high for this size of rotor unless there is a long period of rest between operations.

In equation (3) the constant is $\omega_0 J/9{\cdot}81$ and the unit is kg.m.sec. Ordinates are

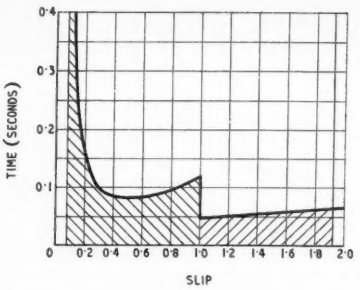


Fig. 2.—K/net torque plotted against slip. The area under the curve represents time (reading from right to left and starting at full-load in reverse; $s = 1 \cdot 9$)

in this case in seconds, which, when multiplied by slip (a ratio), again leads to the area under the curve representing time in seconds.

The moment of inertia (J) must include the whole fly-wheel effect of the moving parts, the effective value of J being found from:—

$$\tfrac{1}{2}J\omega^2 = \tfrac{1}{2}(J_1\omega_1{}^2 + J_2\omega_2{}^2 \ldots + M_1V_1{}^2 + M_2V_2{}^2 + \ldots) \text{ kg.m.}$$

The starting time obviously is directly proportional to the constant K, that is, to the fly-wheel effect. It is for this reason that machine-tool motors are so often built with small diameter and long core. The cast-aluminium rotor also shows an advantage over the equivalent copper rotor; there is a saving of 40 to 50 per cent in active weight and this near the rotor circumference where the saving is most effective.

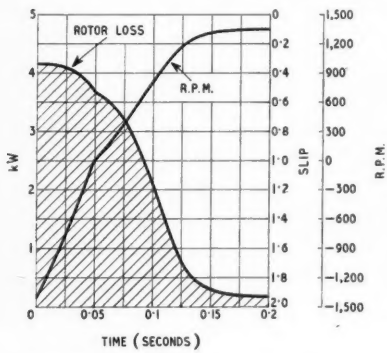


Fig. 3.—R.p.m. and rotor loss plotted against time

Referring to Fig. 2 it will be observed that the curve K/(net torque) tends to the value ∞ as the slip approaches the value where net torque is zero. We can obtain an approximate answer with a margin of error as small as may be justified by the accuracy of our basic data, but the exact time is not calculable. This is quite consistent with the mathematical solution for a motor with free shaft given by Dr. Wall in his article.

Special motor applications sometimes demand that a motor must attain a specified speed within a definite time. There is then no option but to design with a margin to make sure there is some torque in hand at specified top speed.

Mond Nickel Jubilee

TO mark the jubilee of its foundation the Mond Nickel Co., Ltd., has produced "The Story of Mond Nickel," a handsome volume with illustrations by Eric Fraser. After a short survey of the discovery and development of nickel, particular attention is paid to the early work of Ludwig Mond and his associates. The subsequent account of the activities of the company and its associated concern, Henry Wiggin & Co., is a record of hard work and success in the face of recurring difficulties. Reference is made to the merger of the company in the International Nickel Co. of Canada, Ltd., in 1929, and the intensive development from then up to the present day.

An interesting "digression" is a brief account of the establishment of Birmingham Electric Furnaces, Ltd. (now Birlec, Ltd.), resulting from work conducted by Henry Wiggin & Co. on nickel-chromium resistance materials.

Industrial Fellowships

The Mond Nickel Fellowships Committee invites applications for five Fellowships of average value of £750 each for 1952. Fellowships will be awarded to selected candidates of British nationality with degree or equivalent qualifications to enable them to obtain wider experience and additional training in industrial establishments, at home or abroad, to make them more suitable for future employment in senior technical and administrative positions in British metallurgical industries. Each Fellowship will cover one full working year. Applicants will be required to state details of the programme they wish to carry out. Particulars and forms of application are available from the Secretary, Mond Nickel Fellowships Committee, 4, Grosvenor Gardens, London, S.W.1. Completed application forms are required by 1st June.

Sound Reinforcement and Reproduction

By J. L. GOODWIN,*
Graduate I.E.E.

Two-Channel Stereophonic Binaural System

THE many facilities available in most modern public buildings include, in certain instances, a comprehensive sound reproduction system which can contribute greatly to the smooth running of the building. The concert auditorium in the Royal Festival Hall, London (*Electrical Review*, 15th December, 1950) has no proscenium arch in which loudspeakers are usually placed nor could the "ideal" alternative position be chosen on technical grounds because it would have disagreed with the general architectural lines of the hall.

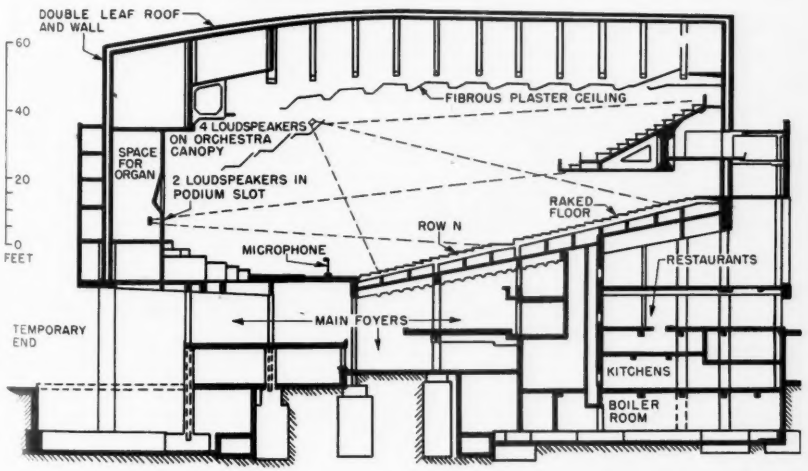
In any auditorium wherein a high-level system of sound reinforcement is employed it is desirable, to secure realism, to have the loudspeakers as near to the human speaker as possible, a condition which is always adverse to the requirements of a good feedback margin. The construction of this hall did not permit loudspeaker sites abreast of the microphone, nor could a position well to the rear of the platform be used because of feedback considerations.

A study of the various angles of the sections of the orchestra canopy showed that from its front leaf the whole auditorium was likely to be covered. But this canopy was lifted several feet during construction, which meant that the loudspeakers would be unlikely to serve the people in the last six rows of the terrace stalls.

Speech tests during the hall-tuning period showed it to be necessary to supplement the main bank of loudspeakers with two directional units in the podium slot behind the choir assembly area of the platform. By controlling the level of these units, the feedback margin was not

* Standard Telephones & Cables, Ltd.

Fig. 1.—Section of the auditorium of the Royal Festival Hall through centre line showing the relative positions of the microphone and loudspeakers



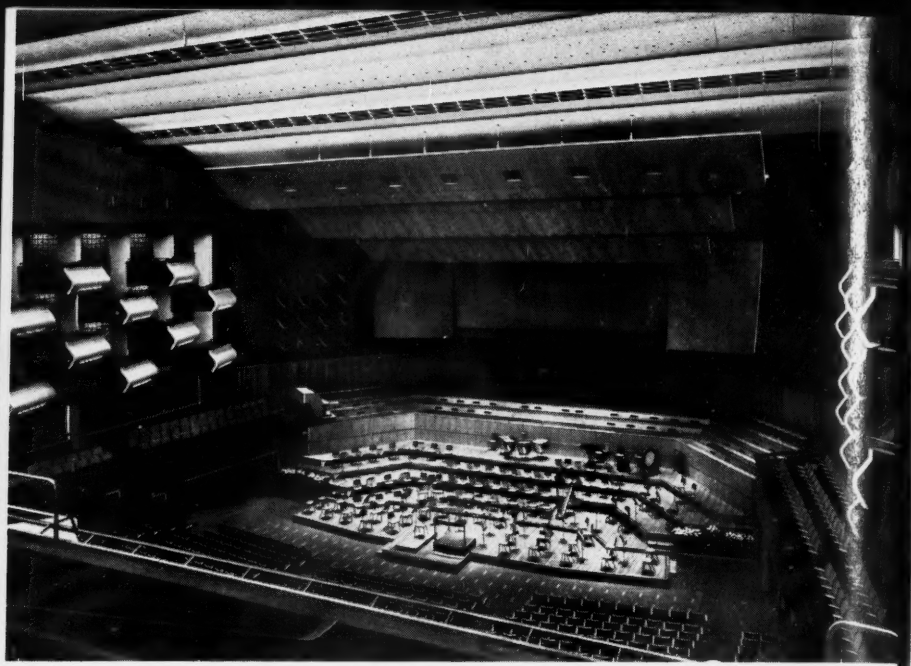


Fig. 2.—Auditorium as seen from the grand tier. Cone loudspeakers are mounted behind four of the seven slots in the reflecting canopy above the orchestral stage

impaired, and a useful degree of reinforcement was obtained in the shadowed area.

Work has recently been carried out under the Department of Scientific and Industrial Research in Great Britain and Germany on the effect of time delays in speech reinforcement systems.[1] It has been shown[2] that improved realism results if the high-level speakers can have a delay of 5 to 35 m/sec introduced into their circuit to ensure that the unaided voice is heard first. Fig. 1 shows that this condition automatically prevails over a large part of the auditorium seating: as an example, row N in the stalls would be subject to a delay of 15 m/sec.

An effort has been made to diffuse the sound as much as possible and for that purpose a bank of four 12in diameter cone loudspeakers has been employed, each of which radiates its energy through a slot 10¹in by 1¹in. This arrangement is employed wherever diffusion of the upper frequencies is required. The presence of the slot avoids the usual focusing of the higher frequencies along the loudspeaker axis and is effective up to frequencies at which the wavelength is comparable with the width of the slot. An almost uniform spread of the higher frequencies is obtained in the horizontal plane up to an angle of 75 degrees each side of the axis.

This diffusion undoubtedly assists the feedback margin under certain conditions, as the loudspeaker response tends to be less "peaky" with this device and there is less chance of a focused higher frequency being reflected back into the field of the microphone.

Type 4033A cardioid microphones, having a back-to-front ratio of 20 db over the major part of the characteristic, have been employed throughout this installation. The use of such microphones in "live" auditoriums materially assists in obtaining a better feedback margin, which is an important consideration when a reasonable level of reinforcement is required without creating a tendency towards acoustic instability.

Fig. 2 is a view of the auditorium looking towards the platform from the grand tier. Seven loudspeaker slots will be noticed; every alternate one is used, so that there are two loudspeakers in operation on each side of the centre slot.

The reinforcement system (Fig. 3) is

fundamentally two-channel stereophonic, with provision for use in the more usual monaural arrangement. There has been great improvement of quality of reproduction in the past ten years and several papers have been written on stereophony.[3–6] It therefore seemed desirable that if this hall were ever to be used for any amount of relay work, or for the reinforcement of certain musical instruments, a binaural system should be provided to give the best realism consistent with cost.

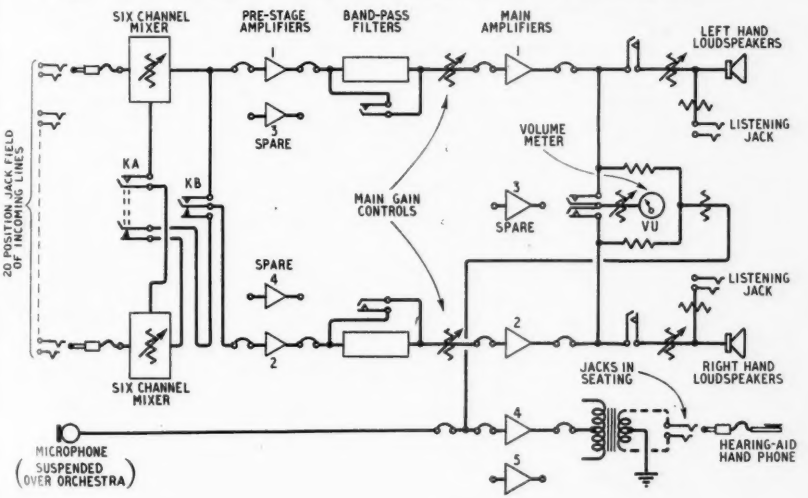
It was considered that twelve microphone faders would satisfy most requirements, but there needed to be many more auditorium microphone circuits and other low-level programme sources. All inputs were brought up on standard Post Office jacks and the fader channels plugged into them as required. Each fader was terminated in a plug on an extensible cord, whose available length was controlled in the conventional telephone switchboard manner by the use of pulleys and cord weights.

The 50 ohm ladder-network faders have a total attenuation of 52 db in steps of 1 db over the main part, but are graded towards the high-attenuation end. They are series connected to form two 6-channel mixers normally feeding the 30 db pre-stage amplifiers 1 and 2. By operating key KA the mixers are connected in series to form a 12-channel mixer into pre-stage amplifier 1 only. The operation of key KB feeds the left channel mixer into the inputs of the pre-stage amplifiers connected in parallel and is the more usual method of operating this system.

A main gain control and speech filter follow the pre-stage amplifiers. The filter has a band-pass characteristic of 300 to 4,000 c/s, being 20 db down at 100 c/s and 10 kc/s. The signal is finally raised for loudspeaker distribution by the main amplifiers of 120 db gain. Each amplifier and important element in the system has its terminations brought up to U-link panels mounted on the front of the equipment racks (Fig. 6) and access to the input or output circuits of the elements is therefore from the panel face, so greatly facilitating maintenance and testing.

A volume indicator[7] can be switched across either output and is not only useful as a visual monitoring device on auditorium volume, but serves as a check on the level being fed to the hearing-aid amplifier. This feed is made through high resistances from each side so that the channel separation is not upset and in the event of one channel becoming non-operative there would be a 6 db change in level, which, though noticeable, is not likely to impair the service to the audience. A secondary source for the hearing-aid system is provided from a separate roof

Fig. 3.—Schematic diagram of the auditorium sound reinforcement and hearing-aid system



microphone, and it is a signal from the latter that is used during a concert when the reinforcement system is not in operation.

Each outgoing channel is split into five circuits and all of them are controlled by individual key switches, three of which have bridged-T line attenuators. One of the latter feeds the two loudspeakers mounted each side of the orchestra canopy centre line (Fig. 2), while the bridged-T attenuators are simply constructed on an " Oak " switch framework and are designed with a total attenuation of 25 db in 10 steps of 2·5 db each. Such an arrangement ensures that the amplifier is always faced with the same load, irrespective of the control settings.

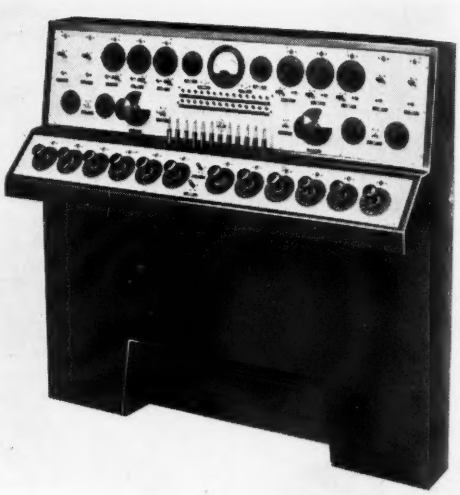


Fig. 4.—The operator's control console is situated in a cubicle in the auditorium

As each line leaves the console it is bridged with a jack that permits an engineer to make aural headphone tests of any outgoing line. The other lines not mentioned in detail above are spare outlets that would generally be used for feeding loudspeakers for overflow audiences outside the main auditorium.

Successful operation and use of a sound reinforcement system in an auditorium depends on the operator being able to hear the reinforced sound himself, instead of relying on a local monitor loudspeaker. The equipment is therefore physically divided into two parts, an operator's control console within the auditorium and the apparatus racks mounted in the central sound-control room.

The control console is in a small cubicle mid-way up one side of the auditorium; the shape of the cubicle largely governed the dimensional design of the console. It is seldom possible for a sound console to use up seating area, so a position adjacent to the terrace stalls with a full platform view was found. The cubicle is 6 by 3 by

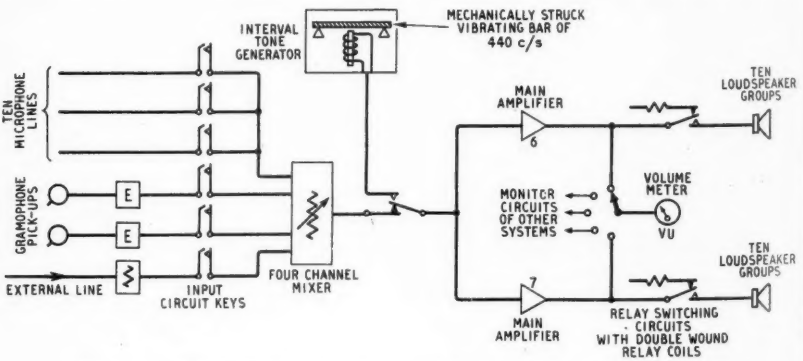


Fig. 5.—Simplified block diagram of the central announcing and interval-tone system

8ft high and has a raised floor, so giving the operator an unobstructed view above the heads of the audience. A net space of by 3ft was left in which to house a console and operator together with ancillary equipment, such as a clock, two telephones and cue-lights control. These physical considerations, coupled with the dual-channel nature of the electrical circuit, led to the rather unusual console (Fig. 4) which resembles a miniature upright piano. Along the narrow sloping front are arranged the 12 faders of the left and right 6-channel mixers; the keys at the centre are KA and KB used for switching between monaural and binaural operation.

This arrangement allows an operator seated at normal chair height to have these controls right at his fingertips, while a short movement allows him to reach a fader plug that is either in the static position or plugged into one of the incoming-line jacks. The larger, nearly upright, panel carries most of the high-level equipment, although the lower central portion of it is screened to accommodate the 28 incoming-line jacks. To each side of this jack field, and fitted with large "shadow" type fader dials, are the main gain controls in each channel, causing a total attenuation of 50 db in 180 degrees of rotation. A volume indicator is mounted centrally and, with its associated sensitivity control and selector switch, can meter either of the two channels.

The top left and right sides of this panel house the loudspeaker-circuit controls mentioned above. The general arrangement, therefore, places the operational controls at the fingertips and the pre-set controls not quite so accessibly. On the reverse side the maintenance engineer is presented with apparatus that is easily reached by removing the rear panel, which in turn forms a portion of the auditorium panelling on the sound-control cubicle.

About 15 per cent of the seating has been equipped with sockets into which hearing-aid headphones can be plugged. The sockets are standard B-gauge telephone jacks and a pair is mounted on a small plate let into the armrest that separates two adjacent seats. The sockets are fed from a hearing-aid amplifier, which is housed in the main rack framework and, as has been mentioned above, receives its signal from the main channels.

The building also has an overall announcing system that can accept inputs from strategic positions and can broadcast an announcement to one or a number of loudspeaker groups. In addition to microphone inputs, this system can accept a signal from two gramophone pick-ups or an external line. The amplifiers are able to accept (Fig. 5) an input from the 4-channel mixer or from the interval-tone generator. The latter takes the place of the more usual bells that are sounded in the refreshment rooms, bars and foyers at the end of the interval period.

Thus the note A (440 c/s) is radiated from a bar (true and of a fairly rich tone as compared with a note from a tuning

Fig. 6. Control desk for the central announcing system (main equipment racks in background)

fork) which is struck by a motor-actuated hammer. The vibrations are converted into electrical energy by a small coil and magnet system mounted beneath the centre of the bar.

The control of this system, apart from switching on the amplifiers, had to be distant and under the care of the concert steward. The loudspeaker relay coils have two windings and the key circuits are arranged so that when the steward operates the interval-note key, he radiates the note to all loudspeaker groups except those that have been previously cancelled by the keys on the panel of this central announcing system situated in the sound-control room (Fig. 6). The keys in the upper row controlling the loudspeaker group relays are shown in the pre-set position ready for the interval-note broadcast. The right-hand desk corner is shown open to expose a well into which a gramophone reproducer may be fitted. The desk "corner" is stowed vertically at the side without impairing the general styling.

The centrally mounted volume indicator has its channel-selector coupled to the monitor loudspeaker switch and permits visual and aural checks of programme levels, thus giving an engineer monitoring facilities on any desired channel.

Headphone monitoring of the hearing-aid system can be done from one of the sockets in the front edge of the desk, the remaining five being provided for additional monitoring that might be required if a simultaneous speech interpretation system is installed for a multi-language conference in the auditorium.

Communication with all parts of the hall is afforded by an automatic house telephone and with the auditorium console by a direct-line central-battery-operated telephone.

The concert hall steward also has direct access to the control engineer over an extension of his specially designed loud-speaking telephone with a transducer built into the desk top and radiating through the slot below the control panel.

Acknowledgments are made to the London County Council, Chief Engineer's Department, and to the director, Building Research Station, for their assistance in the planning and installation of the equipment and to Standard Telephones & Cables, Ltd., for permission to publish this information.

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Atomic Generation

IT would be thirty to forty years before atomic energy would contribute towards the country's resources for electrical generation purposes, said Sir Christopher Hinton during a talk on "Atomic Energy" on 12th February, at the headquarters of the North Western Division of the British Electricity Authority before an audience of engineers invited from the nationalized industries in the North West.

The real future in atomic power production lay in the development of a fast reactor using a pure fissile material and in which neutron bombardment could be accelerated. Although this would create heat transfer difficulties at high temperatures, the main problems now being faced were metallurgical and chemical. Sir Christopher described the fundamental facts concerned with the production of atomic energy.

Among those who attended on behalf of the British Electricity Authority were Mr. W. A. Gallon, controller of the Merseyside and North Wales Division, and his chief officers, together with Mr. Stowell, chief engineer of the Merseyside and North Wales Electricity Board, and Mr. O. Howarth, chief engineer of the North Western Electricity Board, and some of their colleagues. The North Western Division had representatives present from all engineering departments. Sir Christopher was introduced by the controller of the B.E.A. North Western Division, Mr. A. R. Cooper.

VIEWS on the NEWS

By REFLECTOR

IT was with the primary object of stimulating the interest of laymen generally in advances of electrical engineering, at the same time paying tribute to the memory of Michael Faraday, that the I.E.E. instituted the annual public lecture that bears his name. This year's discourse, which has been delivered in London and is now being repeated at several Centres, is by Dr. G. F. Dutton, one of whose Christian names happens to be Faraday. He is describing the recording of sound from the earliest mechanical means to recording on wax, lacquer, tape and film (for talking pictures) as well as the many ways in which records are used in the home, professionally, commercially, industrially and for scientific purposes. Practical demonstrations and lantern slides illustrate progress and the playing of high-fidelity records precedes the delivery of the lecture.

* * *

Beckbury (Salop), the village which, as I have previously mentioned, does not want to be enlightened, continues in the news. A *Manchester Guardian* correspondent, after referring to an abortive meeting called to consider the adoption of the Lighting and Watching Act, 1833, says that they will tell you in the village that "if they did decide to have the electric it might be like the water." It seems that a water main was installed before the war but the supply has been somewhat discontinuous. The correspondent says "it may well be a gentle and experienced scepticism rather than a disposition to love darkness which has caused Beckbury to reject 1833."

* * *

When engineers retire they find that gardening does not provide the mental stimulation to which they have been accustomed all their lives. They retain their interest in their profession and welcome an opportunity of "talking shop," which may rarely present itself. It was therefore a sound idea of retired engineers at Worthing to form an association open to those of their number who are, or have been, members of the leading engineering institutions. Both the chairman (Mr. W. C. S. Phillips) and the hon. secretary (Mr. H. Cooch) are "Electricals." The programme they are arranging is stated to be primarily social but will include visits to works.

* * *

A perennial subject of correspondence and conversation in engineering circles is the use and abuse of the style "engineer." It is raised again by a Canadian correspondent who points out that in Canada it is not permissible for anybody to practise as an engineer unless he is registered. He is then entitled to call himself a "Registered Professional Engineer." The Association of Professional Engineers has asked its members to publicize this term and one suggestion made is that they should insert the letters "P.Eng." after their names. That is one way of doing it I suppose, but it looks rather like an academic qualification, cf. D.Eng., M.Eng. or B.Eng., and may be puzzling to many outside Canada.

* * *

I have pointed out before that fish regard electrical development with distaste. Nevertheless applications of electricity to their discomfiture continue. Among the latest are experiments by the Ministry of Agriculture and Fisheries for clearing coarse fish from waters in which salmon and trout are bred. Apparently two methods can be used. A report on a d.c. method says that this "makes the fish faint and sink to the bottom where they can be picked up." An a.c. system "draws the fish into the electrified area where they can be easily caught in a net." Another report which I have seen lately is that a Fleetwood trawler is to be equipped with under-water television apparatus by which the captain on the bridge will be able to see shoals of fish within a range of fifteen metres to a depth of up to 300 fathoms.

PERSONAL and SOCIAL

News of Men and Women of the Industry

THE Minister of Fuel and Power announced in the House of Commons on Monday that he had appointed **Mr. D. Bellamy,** O.B.E., D.L., F.A.C.C.A., F.C.W.A., F.S.S., Companion I.E.E., as chairman of the Yorkshire Electricity Board. Mr. Bellamy, who succeeds Col. H. M. Lapper, has been manager of the Board's Hull Sub-Area since 1948. He commenced his career with the Kettering U.D.C. and after serving in the 1914-18 war joined the Hull electricity undertaking in 1919 as a clerk in the consumers' department. He was appointed deputy commercial manager of the Electricity Department in 1935 and three years later became general manager.

Mr. D. Bellamy

Upon the nationalization of the electricity supply industry in 1948 Mr. Bellamy was appointed deputy chairman of the Yorkshire Electricity Board, but relinquished that position shortly afterwards to take up the post of manager of the Hull Sub-Area. He was to have been a member of an Anglo-American Productivity Team visiting the United States to study fuel conservation, but was asked by the Board to withdraw as his services were required at home.

Mr. L. E. Brickwell, A.M.Inst.F., has resigned his position as superintendent of the Poole generating station (Southern Division, B.E.A.). He has been appointed chief engineer to International Combustion (Australia), Ltd. Mr. Brickwell had been at Poole since 1950 and he was previously superintendent of Earley generating station, Reading. Mr. Brickwell's successor at Poole will be **Mr. C. J. Stockell,** B.Sc.(Eng.), A.M.I.E.E., A.M.I.Mech.E., A.M.Inst.F., who at present is superintendent of the Earley station. Mr. Stockell was educated at Queen Mary College, London University, and trained with Crompton Parkinson, Ltd., West Ham electricity undertaking, and the Hackbridge Electric Construction Co., subsequently going to Portsmouth generating station as a junior engineer. After holding various posts at Portsmouth he became mechanical engineer at Meaford and then went to Earley as assistant station superintendent in 1948; he has been superintendent there since 1950.

Mr. R. Childs, who from 1939 until last year was export manager of Thorn Electrical Industries, Ltd., informs us that he is now chairman of the Australian White-Lite Co. Pty., Ltd., and director of the International Marketing Group Pty., Ltd., Sydney, N.S.W. The latter company represents a number of well-known British concerns in Australia, New Zealand and Indonesia.

Mr. E. Garthwaite, chief engineer, and **Mr. L. Haine,** engineer in charge of X-ray development, Marconi Instruments, Ltd., left Southampton on the *Queen Mary* for the United States on 19th February. During their visit, which will last about six weeks, they will study the needs of the market in instrumentation and X-ray apparatus at close hand and will have technical discussions with leading specialists and executives in these fields. They will also visit the company's New York office and will be present at the I.R.E. Convention in which the company has participated in recent years.

Mr. M. C. Keen has been appointed manager of the Bristol branch of Siemens Electric Lamps & Supplies, Ltd., in succession to **Mr. J. R. Yeates,** who has taken over the management of their Birmingham branch. Mr. Keen joined the company in 1912 and has served in many capacities both on the inside and outside staff, having been a representative covering most of the Midland Counties for many years. He has for a long time been a member of the Birmingham Electric Club and served in the R.N.A.S. during the 1914-18 war.

Mr. M. C. Keen

Mr. J. R. Yeates

Yeates joined the company in 1946 after two-and-a-half years' service with the Brighton Corporation Electricity Department, and became manager of the company's Bristol branch in June, 1949.

D. J. Crowther, M.A., has been appointed personnel manager to the Metropolitan-Vickers Electrical Co., Ltd., as from 1st January, 1952. Mr. Crowther, who is a son of the late Mr. J. A. Crowther, Professor

Mr. D. J. Crowther

Mr. A. C. Ellis

Emeritus of Physics at Reading University, was educated at Leyton Park School, Reading, and St. John's College, Cambridge. He went to Metropolitan-Vickers in 1939 as a special trainee and in the same year joined the staff of the Education Department as a technical assistant. From 1942 to 1945 he served in the R.A.F.V.R. with the rank of flying officer. On returning to the company he rejoined the Education Department, becoming a section leader in 1951.

Mr. A. C. Ellis has been appointed manager of the Metropolitan-Vickers Cardiff office as from 1st February in succession to the late Mr. H. Coope. Mr. Ellis joined the company in 1920 and after serving his apprenticeship joined the Instrument and Meter Department. For some years he was special representative for meters and protective gear, operating in an area extending from Manchester to Sheffield and Birmingham. About fifteen years ago he was transferred to the Manchester district office and gained the broader experience of handling the wide range of the company's heavy plant products. It is from this position that he is now promoted to become district manager of the Cardiff office, covering an area which embraces Swansea, Bristol and Plymouth.

The presentation of a cheque to commemorate fifty years' service was made recently at the London office of British Insulated Callender's Cables, Ltd., to **Mr. J. Hogan,** export sales adviser, by Mr. W. G. Hendrey, a director of the company. Mr. Hogan joined the former Callender's Cable & Construction Co., Ltd., in 1902, and served an apprenticeship in various branches and offices, after which he entered the Sales and Estimating Department in London, where he later specialized in overseas contracts. Mr. Hogan worked under Mr. Hendrey for many years. In 1923 he was in charge of the Overseas Power Cables Department, and later of the newly formed Overseas Sales and Estimating Department. He continued to serve in the same capacity after the formation of British Insulated Callender's Cables, Ltd., in 1945, until his appointment a few years ago as export sales adviser.

Mr. L. A. Moir is relinquishing his appointment with Parnall (Yate), Ltd., to-day (Friday). He has held the appointment of home sales manager since its inception in 1946, and has been responsible for the formation of the complete sales organization covering Parnall electrical appliances. His home address is 74, Outwood Lane, Chipstead, Surrey.

On behalf of the E.A.W., the president, the Dowager Lady Swaythling, made a presentation on 20th February to **Miss Vera Norvick,** assistant secretary, who has just completed twenty-five years' service with the Association. The gift was a Hanovia combined ultra-violet and infra-red ray lamp, and an additional present was a gold bow for her jewelled watch. The presentation was made in the presence of the National Executive Committee, which comprises members from all parts of the country, and the staff.

Mr. C. A. Pendlington, who has been with the British Electrical & Manufacturing Co., Ltd., Newcastle-on-Tyne, for thirty years, and **Mr. W. A. B. Ames,** Scottish manager of the company also for thirty years, have been appointed to the board of directors.

Mr. I. D. Campbell, B.Sc.(Eng.), A.K.C., M.I.E.E., M.I.Mech.E., informs us that he is shortly resigning his position as chief electrical engineer (power generation and supply) to the National Coal Board.. He is joining Daniel Adamson & Co. as manager of their water-tube boiler department. Mr. Campbell was educated at Darlington Grammar School and King's College, London University and received his training with the Metropolitan-Vickers Electrical Co. After leaving Metrovick he was successively assistant switchgear engineer, English Electric Co.; assistant mechanical and electrical engineer, Air Ministry Works Directorate; technical assistant at Dundee and Hull; generation

Mr. I. D. Campbell

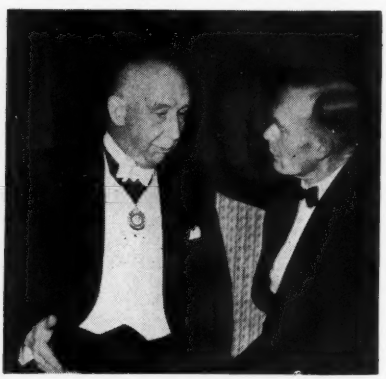
engineer in the latter undertaking; deputy engineer and general manager, Sheffield; and from 1948 to 1949 generation engineer (construction) in the B.E.A. Yorkshire Division.

Mr. J. S. Elliott informs us that he has joined the Brush Aboe group of companies at Dukes Court, St. James', London, S.W.1, and will represent the Hopkinson Electric Co., Ltd., in London and the Home Counties. Mr. Elliott was previously sales manager of the Strong Electric Corporation.

The second annual ball organized by the **Electrical Industries Benevolent Association** (Hants and Dorset Branch), in conjunction with the Southern Division of the British Electricity Authority, was held at the South Parade Pier, Southsea, on 1st February and was attended by more than 500. The function raised over £350 for the Association's funds, £70 more than last year. The Lord Mayor and Lady Mayoress of Portsmouth, Ald. and Mrs. A. Johnson, and other guests were welcomed by the chairman of the Branch, Mr. R. H. Coates (controller, Southern Division, B.E.A.) and Mrs. Coates. Mr. S. E. R. Barker (G.E.C., Ltd.), was the M.C.

Two hundred members and guests of the Brighton, Hove and District Branch of the **Electrical Contractors' Association** attended the Branch's annual dinner and dance at the Old Ship Assembly Rooms, Brighton, on 22nd February last. Mr. F. Tingley, chairman of the Branch, presided. Proposing the toast of the Corporations of Brighton and Hove, the chairman said that Brighton was the first town to have a public electricity supply. In Hove the showrooms had been stocked by contractors; now the undertaking was carried on by another body, but they were happy to find that the men who had worked with them then were now with that other body. The Mayor of Brighton (Alderman E. Simm), replying, said he had been chairman of the Brighton undertaking before nationalization, and he knew both sides. The Mayor of Hove (Councillor A. Brocke) also replied. Mr. Howard Johnson, M.P., proposed the toast of the Association and said that they should not speak of two sides of the industry but of one side. Mr. Stanley N. Watkins, E.C.A. president, replied saying that in its fifty years the Association had made progress all the time and had never stood so high as it did to-day: it now had 3,000 members. Mr. A. L. J. Sayers proposed the toast of the ladies and guests to which Mr. H. W. G. Tingley replied. The toast of the chairman was in the hands of Mr. W. A. Gooding. The chairman was presented with an electric clock.

Mr. Stanley N. Watkins, president of the Electrical Contractors' Association, in conversation with Mr. Howard Johnson, M.P. for Kemp Town Division of Brighton, at last Friday's annual dinner of the Brighton, Hove and District Branch



The annual staff dinner of **Abell & Smith's Electrical Co., Ltd.**, was held on 20th February, about 140 members and guests attending. The toast of the company was proposed by Mr. C. R. Knott, manager of the Pershore branch, and Mr. F. Wilkins (a director) responded. The toast of the visitors was proposed by Mr. G. C. Tysoe (a director), and responses were made by Mr. C. J. W. Scott, representing manufacturers, and Mr. R. Mallet, Sub-Area manager, Midlands Electricity Board. Mr. H. Horton Smith, chairman and managing director, who presided, presented long-service certificates to three employees with twenty-five years' service.

OBITUARY

Mr. Stuart Bell, formerly of the English Electric Co., Ltd., died on 7th January at the age of eighty at his home, Bentinck Drive, Troon. Mr. Bell was educated at Kelvinside Academy, Loretto and London University and served a student apprenticeship with Wm. Denny of Dumbarton. He worked for some time in Argentina, and in 1906 he became Scottish agent for Schuckert & Co. A few years later Siemens took over this concern and Mr. Bell became their first Scottish branch manager operating from Glasgow. When the English Electric Co., Ltd., was formed in 1919 he became joint manager for Scotland and continued in that capacity until he retired.

Mr. W. Storey.—The death occurred on 16th February of Mr. Warren Storey, M.I.E.E., M.I.C.E.(I.) Mr. Storey was educated in Dublin and after training with Egan and Tatlow, electrical engineers, he became their principal assistant. In 1911 he joined the former Great Southern & Western Railway Co., Ireland, as electrical engineer and carried on with the amalgamated concern, the Great Southern Railways Co. In 1945, on the formation of Coras Iompair Eireann (Irish Transport Co.) which included the

Dul... Tramways, he was placed in charge of the ...anization's electrical work. He retired fro... hat position in 1948 and had since acted as ... h engineering representative of J. Stone & C... Ltd., Deptford, London. Mr. Storey was ...hairman of the Irish Centre of the Inst...tion of Electrical Engineers in 1935-36 and ...esident of the Engineering and Scientifi... ssociation of Ireland in 1941.

... **James Lithgow**, G.B.E., who died on 23r... ebruary, was a member of the former Ce... l Electricity Board from its inception in 19... ntil 1930.

...s **Purse.**—We extend our sympathy to Mr. ...nd Mrs. F. W. Purse whose daughter, Doris, died on 18th February. Mr. Purse is hon. director of the National Register of Electrical Installation Contractors. He was formerly engineer-in-chief of the London and Home Counties Joint Electricity Authority and was president of the I.M.E.A. in 1927-28.

Col. J. A. Saner, who was chairman of the Mid-Cheshire Electricity Supply Co., Ltd., Northwich, for many years, died recently at the age of eighty-seven.

Mr. William Henry King died suddenly on 23rd February at the age of seventy-two. Mr. King was proprietor of King & Co., electrical engineers, Park Row, Bristol.

Electrical Research Association

Speeches at Annual Luncheon

MORE than four hundred representatives of member organizations and guests attended the annual luncheon of the British Electrical and Allied Industries Research Association at the Connaught Rooms in London on Friday last. Sir George Nelson, president, occupied the chair.

The company stood in silence as a mark of respect to the memory of the late King George VI before the loyal toast was honoured.

Sir Harold Hartley, chairman of the B.E.A. Research Council and chief guest, in proposing the toast of "The E.R.A." paid a tribute to the late King's understanding of the part that scientific research must play in the well-being of the British people. This country's position in the world had been won largely by engineering triumphs and its strength to-day lay in the same field. Electricity, the newcomer, must play a vital part both as the motive power of our industrial plants and as one of our largest dollar earners. The industry was built on research, which remained its major source of strength. Fortunately, the scientific genius of this country lay in experimental investigation. Britain had won more Nobel Prizes in physics than any other nation—four of the last five prizes had come to this country, so the spirit of research of Faraday and Rutherford was still alive.

The E.R.A. was one of the first research associations, and those who helped to found the Association and had supported its work had every reason to be proud of it. An industrial research organization should contain a judicious blend of ingredients, not forgetting publicity, to win public sympathy and encourage a belief in research. What of the astronomical number of committees on which those present in all their many capacities must be serving to-day? Committees were invaluable in bringing the interested parties together, getting their support and deciding on action. The weak point was that hope sprang eternal in the committee's breast towards its own offspring. There should always be some continuous objective, appraisal of the results of applied research to review priorities and to relieve committees from the slaughter of their own infants.

The appeal for increased subscriptions and a rehousing fund came at a difficult time, but that was one reason why they could not afford to economize on research. With restriction of capital spending, the new building that was so badly needed might have to be postponed a little, but they hoped not for long; therefore the money should be immediately available when it could be spent.

The idea of a moratorium of research was unthinkable, he said, particularly at a time of such rapid development. Take for instance the unsolved problems of

semi-conductors and the rapidity with which their practical applications were invading industry as rectifiers and amplifiers. Sir Harold ventured to guess that the junction type transistor might prove to be the most important single advance in electronics since a control grid was first placed in a tube.

President's Reply

Thanking Sir Harold for his address, Sir George said that two pieces of research among many of which he himself had an intimate knowledge were, first, the research on circuit breakers which even to-day was still a great influence so far as circuitry control was concerned; second, although a great deal less spectacular, the work carried out on dielectrics had also been of benefit in that it had enabled existing designs of apparatus to be made more cheaply and to be more reliable. Those were excellent examples of the basic principles which were followed by those in control of both the supply and manufacturing industries at the time the E.R.A. was founded. The principle was simple but very important, namely, that there should be a centre at which fundamental research could be carried out, detached from industry but on behalf of industry, and that industry itself should ensure that it was in a position to take that fundamental research and apply it to its designs. That principle had been fully vindicated by the fact that to-day the electrical industry of this country was the greatest exporting electrical industry in the world and Sir George paid tribute to the contribution which the Electrical Research Association had made.

The industry had lived up to its responsibility. It had spent very large sums on research equipment and it had done that because it felt that it was necessary if the world was to be served, if the people were to be protected, and if this country was to be in a position to play its proper part in the solution of the greatest problem facing this country, namely, the balance of payments. Very few fully realized the situation they were in to-day and it could not be treated with too much gravity. Through the work of the Electrical Research Association, with the co-operation of the supply industry, the electrical manufacturing industry was helping to solve that problem. That ought to be a special stimulus to subscribers to the E.R.A. and to the officers who were using those subscriptions to contribute to those ends.

The Association could only play its proper part if it had the necessary finance and Sir George therefore warmly endorsed, as a manufacturer and a subscriber, what Sir Harold had said regarding the provision of additional laboratories and equipment at Leatherhead *as early as possible*, in spite of the crisis. Probably one of the times of greatest crisis in his life was the slump in 1932, but he then persuaded his colleagues to put aside many times what was now being asked for to support the E.R.A. It was done for two reasons; to find finance and to improve the basis of knowledge on which a business could expand. Progress should not be slowed up because of the crisis and the provision of the means need not be delayed. His company, already a substantial subscriber to the E.R.A., would pay the suggested larger subscription and also pay a lump sum contribution of two years' subscriptions towards the fund to complete the laboratories at Leatherhead as soon as the work could proceed.

The toast of " The President " was proposed by Mr. H. Astbury, chairman of the E.R.A. Council.

Electrical Contacts

A CONVENTION on electrical contacts is to be held by the East Midlands Centre of the Institution of Electrical Engineers at Loughborough College, Loughborough, Leics, from 7th to 9th April.

The programme will consist of two parts, the first dealing with light duty contacts in theory and practice and the second with heavy duty contacts. The proceedings will be opened on the Monday afternoon by Dr. W. G. Radley, vice-president of the Institution, who will be introduced by the chairman of the East Midlands Centre, Mr. A. W. Hirst.

Those attending the conference may obtain accommodation at Hazlerigg Hall, Ashby Road, Loughborough, at a charge of 21s a night, including meals and registration. For those not staying overnight meals may be obtained at reasonable charges in the College refectory, if booked in advance. There will be a registration fee of 2s 6d for each part of the Convention and both guests and non-members are welcome on the same terms. Further details and registration forms are available on application to the hon. secretary of the Centre, Mr. R. G. L. Ryan, c/o Brush Electrical Engineering Co., Ltd., Loughborough, Leicestershire.

National Fuel Policy

F.B.I.'s Proposals to Ridley Committee

IT August the then Minister of Fuel and Power (Mr. P. Noel-Baker) set up a Committee under the chairmanship of Viscount Ridley to report on steps which might be taken to promote the best use of the nation's fuel and power resources; Sir Claude Gibb (C. A. Parsons & Co., Ltd.) was one of the members.

Evidence is being heard and collected by the Committee and among those who have submitted statements is the Federation of British Industries. The statement was published this week.

After a general review of the coal and power situation as it affects industry, the Federation points out that even under the present restrictions the amount of coal available is insufficient to meet requirements and exports have had to be seriously cut. By 1960–65 the annual shortage, now from 10 to 20 million tons, will rise to 50 million tons unless plans are made to deal with the situation.

Choice of Fuel

Production should be increased but at the same time more attention must be paid to efficiency of use. The F.B.I. hopes that the Committee "will not shrink from the task of recommending a policy aimed at promoting the choice of the most efficient fuel for each main category of use."

It is expected that the Committee will review the relationship between the capital investment programmes of the coal mines, power stations, gasworks and oil refineries and the main fuel consuming categories with the object of satisfying itself that these are in step. The Federation says "there will be nothing but loss to the nation if plans to develop coal consumption by power stations, industry or export appear likely to outstrip the coal supply, or if plans to develop the consumption of electric power appear likely to outstrip the generation or distributing capacity of the electricity industry."

Dealing with the economies in industry, the F.B.I. says that means of encouraging the replacement of obsolete fuel-burning and fuel-using equipment must be found. It suggests the provision of Government loans on favourable terms or taxation relief in respect of expenditure upon new equipment.

Power Station Efficiency

With regard to the generation and use of electricity the Federation says that its concern is to be assured of sufficient supplies of electric power in the years ahead and to be rid as soon as possible of peak-load problems. It suggests the following questions on various aspects which should be studied by the Committee:—

In following the policy of building large power stations of the condensing type, based on the desire to secure the utmost economy in the consumption of coal and to make the most effective use of capital expenditure, has sufficient account been taken of the low thermal efficiency of the condensing cycle? Are the consequential disadvantages of location, such as remoteness from industry and coal mines, sufficiently weighed?

Has the wider use of generation by back-pressure turbine and steam-engines in industry, linked where suitable to the public supply, been sufficiently encouraged? Has the contribution of auxiliary oil engine generators to the peak-load problem been fully assessed?

Has the question of the construction of steam power stations of small size and designed specifically to cater for winter peak loads been examined? Could such plants be located at or near centres of load and operate with lower steam conditions and with less elaborate boiler houses than main base-load power stations require? Could they be housed in simpler buildings involving a considerable saving in capital and maintenance costs that might offset the increase in fuel costs? To what extent would the situation of such stations near industry facilitate the adoption of district heating and/or back-pressure generation of process steam, and also effect savings in transmission costs?

In the matter of domestic use, the F.B.I. says that the limitation of solid fuel has resulted in a rapid rise of gas and electricity consumption. It is suggested that competition between gas and electricity has been based in the past on price structures which may not reflect thermal efficiency. In addition gas and electricity have obvious advantages for casual domestic use. The Simon Report is quoted as stating that in terms of "coal economy efficiency" gas ranks at about 30 per cent and electricity at only 18 per cent "measured at the point of continuous use." The greater use of efficient modern solid-fuel appliances is favoured.

PARLIAMENTARY NEWS

From Our Special Reporter

IN the House of Commons on Monday, Wing/Cdr. Bullus asked the Minister of Fuel and Power what were the circumstances which led to the resignation of the newly-appointed chairman of the Yorkshire Electricity Board, and if he would announce the name of his successor.

Mr. Geoffrey Lloyd said that Mr. J. S. Pickles asked if he could return to the South West Scotland Electricity Board for personal reasons. He had appointed Mr. D. Bellamy, formerly sub-area manager, to be chairman of the Yorkshire Electricity Board.

Wing/Cdr. Bullus asked the Minister if he would make a statement as to his findings regarding the incorrect information supplied by his Department last year in connection with the building licences granted to the Yorkshire Electricity Board. A similar question was asked by Mr. Marlowe.

Mr. Lloyd replied that Sir Godfrey Russell Vick, Q.C., chairman of the Bar Council, had inquired into the circumstances in which this incorrect information came to be given. He had interviewed all the officers of the Department and of the Yorkshire Electricity Board who were able to throw any light upon the matter and he had now sent him his report. A fair summary of his conclusions was that the main responsibility for the incorrectness of the information given by the Minister's predecessor must rest on the senior officers of the Yorkshire Electricity Board. They had ample opportunity of correcting the form of reply which had been suggested to them by an officer of his Department as being the correct way of expressing the information he had been given at short notice over the telephone. But though misled by this information, the departmental officers concerned must bear some responsibility for allowing the draft reply to go forward when it should have been obvious that no satisfactory reply could at that time be given. Part of the difficulty in this case arose out of the form of authorization, which dated from the early days of the war and was designed to meet wartime conditions. He was arranging to alter the form of authorization for building work on offices, showrooms, and the like so as to make it quite clear that the work was controlled not only by the plans but by the sum of money specified in the authorization.

North Western Board Appointments

Mr. Erroll asked the Minister of Fuel and Power what steps he was taking regarding those persons whose appointment to the North Western Electricity Board terminated during 1952.

Mr. Lloyd said that the present terms of the persons concerned expired towards, or at, the end of the year, and in due course he would consider the action to be taken in accordance with the powers conferred upon him by the Electricity Act, 1947.

Electricity Charges

Replying to Mr. P. Bell, Mr. Lloyd said that domestic tariffs had for many years contained an element varying in accordance with the size of the house, the number of rooms, or the rateable value, and he did not propose to issue any general direction to the B.E.A. in this matter.

Electricity Supply Regulations

Mr. Nabarro asked the Minister what steps were being taken to revise, bring up-to-date, and reprint the Electricity Supply Regulations, 1937, for securing the safety of the public and for ensuring a proper and sufficient supply of electrical energy, in view of the manifold developments of electrical appliances during the last fifteen years, and whether his revised regulations would deal with initial and periodical inspection of domestic installations.

Mr. Lloyd said that the revision of the Electricity Supply Regulations, 1937, was at present being considered.

Budget Date Postponed

It was announced in the House of Commons on Monday last by Captain Crookshank, Leader of the House, that the date of the Budget had been postponed for a week to Tuesday, 11th March.

OVERSEAS ELECTRICAL TRADE

January's Exports Go Still Higher

A PROMISING start for 1952 has been made in the exports of electrical apparatus and machinery. The January figures at £17,016,936 were £11,716 above the highest total previously recorded (in November last) and no less than £4,683,198 above the January, 1951, amount. Actually the contribution of the electrical industry to the export trade is considerably greater than is revealed by these statistics, since no account is taken of such items as refrigerating machinery, machine tools, mechanical handling plant, air conditioning apparatus, pumping plant, woodworking machinery, welding equipment, etc., which are largely, if not predominantly, electrically operated.

Nearly £2½ million of the increase over the January, 1951, figure came from expansion in sales of electrical goods and apparatus. Australia (£1,282,089), India (£850,584) and South Africa (£773,739) accounted for a substantial part of the £10,065,062 total. Good business was done

TABLE I.—ELECTRICAL EXPORTS

Class	January, 1951	January, 1952
	£	£
Telegraph and telephone cables and wires (submarine)	35,921	60,234
Ditto, not submarine	641,258	541,496
Wires and cables, paper insulated	543,436	744,556
Ditto, rubber insulated	458,418	761,467
Ditto, cotton, silk or artificial silk insulated	81,577	70,021
Ditto, enamel, glass or asbestos insulated	116,606	85,986
Ditto, other	205,959	336,814
Commercial radio apparatus	414,008	556,256
Domestic radio apparatus	305,970	474,023
Telegraph, telephone and signalling apparatus	1,442,324	1,628,251
Radio loudspeakers	59,083	81,341
Telecommunication components, n.e.s.	446,763	578,762
Other telecommunication apparatus	102,754	143,523
Valves and cathode ray tubes	269,596	322,746
Carbons	36,828	44,172
Lamps, exceeding 24 V	87,923	114,986
Ditto, not exceeding 24 V	37,202	58,659
Other lighting appliances	354,018	502,326
Primary batteries	160,921	213,574
Parts other than carbons	16,847	51,102
Accumulators for motor vehicles	176,025	293,009
Ditto, traction	13,848	44,556
Ditto, radio	10,201	2,564
Other portable accumulators	120,859	58,281
All other accumulators	35,554	45,632
Parts and accessories	62,147	84,778
Cooking appliances	139,069	312,188
Heating appliances	68,337	94,955
Parts and accessories for cooking and heating appliances	69,791	85,548
Flat irons	50,325	51,153
Commercial electrical instruments	126,933	137,535
House service meters	132,192	149,543
Time recorders and time switches	15,545	11,394
Other electrical instruments	136,455	108,987
Electro-medical apparatus (not X-ray)	54,395	52,351
X-ray apparatus, tubes and parts	128,051	210,746
Permanent magnets	21,657	31,664
Insulating cloth and tape	106,389	125,558
Other insulating materials	86,737	125,815
Unclassified electrical goods and apparatus	370,105	668,510
TOTAL electrical goods and apparatus	7,742,007	10,065,062
Diesel driven generators not exceeding 200 kW	369,914	441,383
Ditto, exceeding 200 kW	175,924	169,688
Other generating sets	328,360	305,453
Generators exported without prime movers, and parts of generators	224,343	616,872
Motors, railway, tramway and trolley bus	20,146	6,134
Ditto, other, not over ½ h.p.	111,982	224,525
Ditto, over ½ h.p. but under 1 h.p.	38,587	83,106
Ditto, from 1 h.p. to 250 h.p.	452,416	569,151
Ditto, exceeding 250 h.p.	145,943	122,708
Ditto, parts	74,860	78,765
Converting machinery	14,328	6,454
Transformers, including coils	534,784	748,587
Rectifiers for power house use	77,770	32,839
Motor starting and controlling gear	202,762	224,058
Switchgear and switchboards (not telegraph and telephone)	756,114	1,441,498
TOTAL, electrical machinery	3,528,233	5,071,221
Washing machines (not exceeding 250 lb weight)	290,580	699,778
Ditto, parts	23,241	29,083
Vacuum cleaners	205,023	236,501
Ditto, parts	49,136	56,231
Other electrically operated portable appliances and parts	133,301	366,477
Portable electric tools	123,888	129,212
Unspecified electrical machines, machinery and parts	338,329	363,371
GRAND TOTAL	12,333,738	17,016,936

with most African countries and with Scandinavia and considerable increases were recorded in exports to the Irish Republic (from £230,445 to £369,667), Portugal (from £29,742 to £121,679), Greece (from £39,683 to £111,251), Turkey (from £19,023 to £162,697), Israel (from £24,374 to £62,593), Arabia (from £9,757 to £40,602), Venezuela (from £39,671 to £90,955) and Chile (from £29,4[illegible] to £56,790). Although trade with C[illegible]ada improved from £178,133 to £25,212, shipments to the United States fell from £168,759 to £84,227, as did also th[illegible]e to Brazil (from £271,482 to £112,293).

Table II.—Distribution of Electrical Goods and Apparatus

Destination	January, 1951	January, 1952
	£	£
Channel Islands	46,956	33,595
Gibraltar	30,837	6,219
Malta and Gozo	7,583	16,515
Cyprus	23,795	12,970
British West Africa	155,916	256,488
Union of South Africa ..	725,421	773,739
Northern Rhodesia	17,923	61,437
Southern Rhodesia	146,135	137,587
British East Africa	105,759	165,447
Bahrein, Qatar and Trucial Oman	20,989	32,383
Kuwait		38,816
India	659,884	850,584
Pakistan	191,934	221,937
Malaya	259,238	426,365
Ceylon	72,278	159,612
Hong Kong	190,580	225,330
Australia	1,232,180	1,282,089
New Zealand	479,539	701,015
Canada	178,133	253,212
British West Indies	114,868	138,313
Anglo-Egyptian Sudan ..	28,538	77,224
Other Commonwealth Countries	42,295	145,526
Irish Republic	230,445	369,667
Soviet Union	6,603	18,176
Finland	21,871	123,779
Sweden	201,751	328,673
Norway	99,825	175,768
Iceland	18,335	25,237
Denmark	84,480	81,636
Poland	68,284	46,608
Germany	18,335	52,646
Netherlands	201,381	281,975
Belgium	106,091	159,417
France	122,607	115,246
Switzerland	31,702	54,585
Portugal	29,742	121,679
Spain	53,813	28,714
Italy	85,036	84,049
Austria	21,453	53,141
Czechoslovakia	14,205	15,016
Greece	39,683	111,251
Turkey	19,023	162,697
Portuguese East Africa ..	9,485	13,308
Syria	19,853	9,124
Lebanon	14,670	32,650
Israel	24,374	62,593
Egypt	156,851	165,668
Arabia	9,757	40,602
Iraq	118,340	93,645
Iran	180,990	22,215
Burma	29,537	85,075
Thailand	27,399	23,287
Indonesia	24,457	58,517
China	53,883	14,575
United States of America ..	168,759	84,227
Venezuela	39,671	90,955
Peru	57,362	25,330
Chile	29,460	56,790
Brazil	271,482	112,293
Uruguay	31,250	26,674
Argentine Republic	130,090	155,853
Other Foreign Countries ..	138,891	165,318
Total ..	7,742,007	10,065,062

With regard to the individual clas[illegible]fications, it will be seen from Table I tha[illegible]only electro-medical apparatus and certain [illegible]ypes of cables and wires, batteries and i[illegible]truments failed to attain the January, [illegible]951, figures. A fall of approximately £1[illegible],000 in exports of telegraph and telephone [illegible]bles and wires (not submarine) was due l[illegible]gely to reduced purchases by Australia (£4[illegible]159, compared with £248,833), though to offset this there were increased exports to New Zealand (£129,574, compared with £77,728). India £136,074 (against £75,647), Australia £163,399 (£137,731) and Egypt £30,359 (£730) helped to raise the total for paper insulated cables from £543,436 to £744,556, while New Zealand £116,034 (against £54,161) and Malaya £71,692 (against £15,863) contributed to the improvement from £458,418 to £761,467 in exports of rubber insulated types.

Sweden (£117,680) was the best customer for commercial radio apparatus, Malaya (£69,794) taking the most domestic radio apparatus. A rise from £1,442,324 to £1,628,251 in overseas sales of telegraph, telephone and signalling apparatus occurred despite much reduced buying by Australia (£297,835 compared with £465,050) and Iran (£1,053 compared with £99,541). By increasing its demands from £66,383 to £205,742 worth, Australia was mainly responsible for the advance from £277,197 to £492,691 in exports of cooking and heating appliances.

Although there were reduced demands for rectifiers, convertors and certain types of generators and motors, overseas sales of electrical machinery as a whole were £1,542,988 above those for the corresponding month of 1951. By purchases valued at £272,281 (compared with only £1,221 worth in January last year), Spain heads the list of buyers of generating plant, the next best markets being India (£206,065) and Australia (£199,047). Russia's share fell from £116,997 to £233. Australia was the best market for both motors (£262,509 out of a total of £1,084,389) and "other electrical machinery" (£563,297 out of £2,453,436).

Dynamo-Electric Machinery

Inherent Current, Voltage and Speed Control

The development over the last thirty years of dynamo-electric machine systems so designed that control of current, voltage and speed is inherent, was reviewed in the paper by Messrs. J. C. Macfarlane, J. W. Macfarlane and W. I. Macfarlane (Macfarlane Engineering Co., Ltd.) presented last week to the Utilization Section of the Institution of Electrical Engineers.

Starting with the concept of the Kramer type three-coil dynamo the paper outlined the methods by which a successful constant current d.c. generator was made and showed how they became applicable to constant voltage, constant current, d.c. convertors and to the control of alternator voltage, the voltage of variable speed d.c. machines and of speed. The development of feedback convertors of these kinds led, in turn, to amplifying dynamos, two basic types of which were compared in the paper. Instead of using a split armature or split field machines they could be cascaded so that one axis magnetized the other, the reaction of the first on the second being suppressed. In this way two-stage amplifying dynamos were obtained which were sensitive to small changes of field in the primary axis and also, therefore, to currents in suitably placed control circuits.

The split pole machine had been developed in the United States under the trade name "Amplidyne," while the split armature machine had been similarly developed in the United Kingdom under the trade name "Magnicon." The authors described the latter in greater detail because of their experience of this type and because they considered it had not been so well documented in technical articles.

To ensure stability, rigidity and rapidity of control of current, voltage, or speed by such feedback means the machines controlled must be designed to react quickly, which was done by providing compensating windings or compensating m.m.f. Such windings made it possible to employ copper-type machines having large electric/magnetic load ratios, large diameters and short air gaps, with relatively small field fluxes and m.m.f./pole.

The following advantages resulted. The time constants of the field windings fell very rapidly with increases of the above ratios. The ratio of the possible corrective m.m.f. to the effective field m.m.f. under transient load changes was relatively large, so that the corrective changes were relatively more powerful, particularly in the case of d.c. machines in parallel. By using small capacity exciters with "high ceiling" forcing voltages far better control was obtained in constant current circuits than was possible with conventional shunt wound or compounded exciter-less generators.

Two exciter systems were described, one in which stability and rigidity of control were obtained by employing modified Kramer windings and a "high ceiling" voltage, the other being the "Magnicon" amplifying exciter. The former system could be readily applied to the excitation of constant voltage generators, and, in some respects, similar control conditions could be obtained if the ceiling voltage employed was six times that of the amplifying exciter. The differences between the two systems were tabulated for comparison, indicating that the "Magnicon" system was perfectly safe even when the control circuit failed. The authors considered that many opportunities for profitable research were still available.

DISCUSSION

Mr. K. C. Barwick (B.T.H.) opened the discussion with a reference to the use of the three-coil dynamo in excavators and in diesel-electric locomotives as well as the use of the three-coil exciter to control the main generators of d.c.-propelled diesel-electric ships, but said that probably the number of applications of both would tend to decrease. Future equipments were

much more likely to use "Amplidynes," "Metadynes" and "Magnicons." The three-coil machine was suitable only for the simpler forms of automatic control, whereas amplifying dynamos could be arranged to give any characteristic likely to be wanted and control could usually be effected by using smaller currents and therefore smaller regulating devices.

Capstan Operation

Mr. H. Martin (British Welding Research Association) said that in naval work, primarily for the operation of capstans and the like, the special features of the Austin version of the Thury constant-current system had proved of outstanding benefit. The ability of capstans when hauling in heavy warships against wind and tide to stall and even yield at a predetermined pull without any danger of tripping the circuit breaker was an important achievement.

In 1937 adverse effects in metallic-arc welding were encountered with multiple-operator d.c. supplies from welding motor generators, due to the sluggish response to load changes inherent in salient-pole solid yoke construction. With a Macfarlane machine, however, when steadily depositing molten metal other electrodes connected to the same source of supply could be flashed in and out of contact with a plate connected to the opposite pole without the slightest trace of interference with the skilled operator.

Major-General W. S. Tope (Henry Meadows) referred to the earlier work of Rosenberg, who in his design of constant-current generators had been the first to make use of armature reaction to provide the cross flux and, in the opinion of some, anticipated the "Metadyne" and produced the first rotating amplifier.

Rapid Rate of Response

Mr. L. G. Greenwood (Crompton Parkinson) made various detailed criticisms, but said it must be conceded that with the "Magnicon"-alternator combination the rate of response was definitely very rapid. The fully-laminated structure of the alternator and the distributed field were of help in this connection.

Mr. G. Brombley (Admiralty, Bath) observed that it was unfortunate that in these days the general tendency in electrical engineering seemed to be to solve all machine control problems by the use of electronics. The paper should help to show the industry what could be done by taking advantage of the inherent characteristics of machines. There was a tendency to use constant-current schemes for ship propulsion, employing "Amplidyne" or "Metadyne" control. There were special applications for which this was necessary, but in other cases electrical engineers would be wise to stick to the simpler three-field type of machine, which marine engineers would understand more easily. The "Magnicon" alternator appeared to be the right sort of machine for ship work. In recent years some shipowners had begun to think in terms of a.c. and the fact that the machine could be paralleled very easily and had no automatic voltage regulator were advantages in marine work.

Mr. J. McTaggart (B.T.H.) questioned the authors' use of the word "inherent." When the control function was wholly or partly removed to a regulating exciter it was no longer correct, he contended, to speak of inherent control or the inherent characteristics of a generator.

First Developed in Britain

Mr. H. V. Tucker (Metropolitan-Vickers), while agreeing with the authors that the split-pole convertor had been developed in the U.S.A. under the trade name "Amplidyne," pointed out that prior to that its development had taken place in this country under the trade name "Metadyne." The latter, he said, had had very extensive applications in the late war, for gun control and other purposes. At present further progress was being made in this application and, in addition, the "Metadyne" was making an ever-increasing contribution to general industrial requirements. The "Amplidyne" was no more than a particular form of "Metadyne." He suggested that the "Magnicon" alternator might be described as a compensated alternator, although all alternators were compensated by virtue of their exciter characteristics, but it was incorrect to describe it as having any inherent regulation characteristic superior to that of a conventional alternator fitted with an automatic voltage regulator.

Mr. J. C. M. Sanders (Brush Electrical Engineering) thanked the authors for inventing what he described as "this wonderful little machine." They had done well, he said, to get rid of the external regulator and

he would like them now, if they could, to get rid of the exciter altogether.

Mr. J. Griffin (Crompton Parkinson) remarked that the "Magnicon" excitation system was virtually a servo mechanism, but did not see that the authors' form of alternator was any more compensated than any other form. The conventional alternator design was not dictated to-day by regulation but was based mainly on temperature rise. He saw no point in using a large ratio of armature m.m.f. to field m.m.f., as the authors were doing, because it gave the regulating device more work to do than was necessary. There should be, however, a very wide field for the "Magnicon," but he thought that the combination of "Magnicon"-regulating exciter in small sizes with the inverted salient-pole alternator was more suitable, more efficient and more economical than the authors' type of machine.

Mr. H. T. Price (Brush Electrical Engineering) said that while the authors stated that with the "Magnicon" exciter they required only a relatively low value of magnetizing ampere-turns they had still to consider the ampere-turns required for the compensation of the armature reaction. Therefore in some measure the concentrated field salient-pole type alternator must be more efficient than any type of distributed field winding.

Mr. B. Jubb (Crompton Parkinson) pointed out that the "Magnicon" alternator could give two levels of voltage simply by altering the control of the field. That was something which had been wanted very much in the Services. He had not seen a machine on the market which would approach the "Magnicon" method of having field control to give two distinct voltages, which could be in the ratio of 2/1 or 1·73/1, giving the star-delta effect, which should be of advantage for selling overseas against American competition.

Mr. W. I. Macfarlane replied to the discussion.

CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Earthing and Protection

NO. 1006 of the I.E.E. Wiring Regulations permits alternative earthing methods (*a*) by earth leakage protective device only, or (*b*) by solid earth connection in parallel with the protective device. Now comes the report of a recommendation that where earth leakage circuit breakers of the voltage-operated type are installed, the installation they protect should be provided *as standard practice* with a connection to earth, quite distinct from that obtained through the trip-coil of the earth leakage circuit breaker.

In support, it is suggested that the parallel earth connection would ensure greater safety in cases in which the resistance of the supply transformer neutral to earth path is high in comparison with the total resistance to earth at the users' premises. This proposal, incidentally by no means novel, is more interesting than convincing, especially when considered in the light of E.R.A. report V/T 109 on "the incidence and avoidance of high resistance joints in steel conduit runs in service" (which publication could hardly have appeared more opportunely).

Mr. T. C. Gilbert, M.I.E.E., an authority on earthing and installation problems, objects generally to direct parallel earthing with voltage-operated earth leakage circuit breakers on the following main grounds:—

(1) Regulations require earth leakage protection where direct earthing is doubtful or dangerous; why retain the suspect method? (2) The use of the parallel earth connection precludes easy testing of the earth continuity conductor from the appliance itself. (3) With a parallel direct earth in being, there is serious risk of connection of the protective device earth to the same electrode, resulting in short-circuiting, or the installation of the protective device earth within the sphere of influence of the direct earth electrode,

probably stultifying protection by the former.

Admittedly, untested earth leakage protection gives a false sense of security, but why compel the introduction of additional gear which may itself restrict such test? In engineering, examples abound of additional "safeguards" which in practice may defeat their object by introducing corresponding complications.

The advocates of the parallel earth method say in effect: "Is not a designed direct earth in parallel with the leakage protective device to be preferred to a fortuitous one somewhere back in the circuit?" This has prompted the apt rejoinder by Mr. Gilbert that this is tantamount to inquiring whether it is not better to break your neck deliberately, rather than run the risk of having it broken in a traffic accident.

The fact that discussion on various methods of earthing protection has raged for years among responsible technicians, indicates that any attempt to enforce a particular method or combination of methods would be unwise. The choice of alternatives is a matter best decided according to the individual characteristics of a particular electrical installation.

Denham, Middlesex. R. B. FAIRTHORNE, M.I.E.E.

Bedroom Heating

I DO not know exactly what Mr. Bates (22nd February) is referring to when he mentions "the medical objections associated with sleeping in heated bedrooms." I hope 50 deg F will not be considered too high a temperature, because, if it is, I shall include this particular medical objection with a few others from the same source.

It seems to me that a bedroom with thermostatically controlled background tubular or convection heating of 50 deg F provides a very useful degree of comfort with quite small power consumption. For the short periods of undressing, such heating can be supplemented by a radiant fire; for dressing, personal experience has shown that with the above-mentioned background heating, supplementary heating is unnecessary—a good point so far as peak load periods are concerned.

Broxbourne, Herts. T. L. FRANKLIN.

Electricity Supply "Productivity"

Return Visit by Americans

AT the invitation of the British Electricity Authority and by arrangement with the Anglo-American Council on Productivity, a representative team from the American electricity supply industry is visiting this country to discuss problems with members of the British electricity supply industry.

The team of eighteen, led by Mr. Chandler W. Jones, vice-president, Narragansett Electric Co., Rhode Island, is drawn from employees at all levels in the United States electric light and power utilities. The party is due to arrive at London Airport to-morrow (Saturday) morning, and will return to America on 10th April.

The party, which is a "reverse flow" to the productivity teams from the British electricity supply industry which visited the United States at the end of 1949, will be received by Lord Citrine and members of the British Electricity Authority. Opportunity will be afforded the visitors to examine the British electricity supply industry in all its aspects and to exchange views with their "opposite numbers" on the practices in their respective countries. Among the subjects to be covered are generation, transmission and distribution, engineering and construction, labour/personnel relations, and commercial practices.

Arrangements have been made for the party to undertake a tour covering a number of the Area Boards and the Authority's Generation Divisions. Visits will be paid to main centres of transmission and distribution, power stations—thermal and hydro-electric—and the industry's research and educational establishments. At the invitation of the North of Scotland Hydro-Electric Board the party will also be shown some of the hydro-electric schemes which are being developed by that Board.

The tour will begin from London on 6th March, the itinerary being by way of Cambridge, Birmingham (7th and 8th), Leeds (9th to 11th), Tynemouth (12th to 14th), Gullane (15th), Edinburgh (16th and 17th), Pitlochry (18th and 19th), Glasgow (20th and 21st), Carlisle (22nd), Manchester (23rd), Liverpool (24th), Chester (25th), Hereford (26th), Cardiff (27th and 28th), Bath (29th and 30th), and Bournemouth (31st March and 1st April), ending in London on 2nd April.

Commerce and Industry

Scottish Television Conference

Increased Steel Prices

To mark the opening of the Kirk o'Shotts television transmitting station the Scottish Section of the British Institution of Radio Engineers is to hold a conference and exhibition in Glasgow on 14th and 15th March.

An ambitious programme of papers on many aspects of television will be presented and a number of radio manufacturers are to co-operate in the exhibition by displaying receivers, aerials, test gear and other items of television equipment. A registration fee of 7s 6d will be payable by all taking part in the conference, which is not limited to members of the Institution. Further details may be obtained from the Hon. Secretary of the Scottish Section, Mr. R. H. Garner, 66, Buchanan Drive, Cambuslang, Lanarkshire.

Contract Price Adjustment Formulæ

The following are the latest figures for use in the B.E.A.M.A. contract price adjustment formulæ:—Rates of pay: the rate of pay for adult male labour at 16th February shall be deemed to be 134s. Cost of material: the index figure for intermediate products published by the Board of Trade on 16th February is 369·8 and is the figure for January.

Increased Farm Productivity

A series of broadsheets explaining to farmers how the wise use of electricity on the farm is both an aid to greater productivity and reduced labour costs is being prepared by the British Electrical Development Association. The first four of these illustrated folders deal with "Barn Hay Drying," "Platform Grain Drying," "The Small Automatic Hammer Mill" and "Clean Milk Production."

Each folder deals with the subject briefly, with the method of operation, the advantages of electricity, installation methods and layout, and running costs. For example, the folder on platform grain drying states that a 30-sack dryer for a ½ per cent drying rate needs a ½ h.p. fan motor and a 15 kW heater: with this equipment, the electricity used to dry a ton of grain by 5 per cent would be about 100 kWh.

The folder on clean milk production, besides drawing attention to the hygienic and labour saving features of electricity, points out that one kWh of electricity will milk 24 cows; cool 20 gall of milk, using a 2-stage cooler, or 12 gall using a chilled water cooler; or provide 6 gall of water at hot-washing temperature. Seven kWh would provide for sterilizing a 4-unit bucket milking plant with a detachable milk cooler.

Copies of these leaflets can be obtained either from the Electrical Development Association, 2, Savoy Hill, London, W.C.2, or from electricity service centres.

Bedwarmers and Heating Pads in N.S.W.

The Electricity Authority of New South Wales has recently issued a proclamation under the Electricity Development Act to the effect that non-flexible electric bedwarmers and flexible heating pads may not legally be sold or hired in New South Wales, after 1st January, 1953, unless they comply fully with the relevant specifications published by the Standards Association of Australia and are stamped or labelled with the letters "P.S." together with a registered guarantee number. Alternatively, the appliances must be stamped or labelled with a reference number or mark signifying that they have been approved by a statutory authority in another State or territory of the Commonwealth. Interested British manufacturers may obtain further information regarding the relative Australian Standard Specifications, and particulars of the test fees, on application to the British Standards Institution, 24/28, Victoria Street, London, S.W.1, quoting reference ELE/38.

Welsh Industrial Directory

The second edition of the "Industrial Directory of Wales," which has just been published, forms a valuable guide to the industrial development of Wales. Since the first edition was published in 1948, more industries have been established in the area, and these are included in the new edition. The editorial features have been completely revised and re-written by executives of the principal industries, and the contributors include Mr. J. Eccles (chairman, Merseyside and North Wales Electricity Board), who deals with the work of his Board, and Mr. L. Howles (chairman, South Wales Electricity Board), who does the same for South Wales. The directory section includes a classified list of products and services alphabetically arranged, and an alphabetical list of names and addresses, with details of products and services. The directory is published by the Industrial Association of Wales and Monmouthshire at 10s 6d

and can be obtained from the Association offices at Aberdare House, Mount Stuart Square, Cardiff.

British Council Courses

The British Council's 1952 programme of courses, distributed in more than 60 countries, is designed to attract some 1,000 visitors from overseas between March and November to spend study periods of from two to three weeks in the United Kingdom. The courses are to be held in more than twenty different centres in England, Scotland and Wales and individual fees for tuition and accommodation vary from £23 to £38.

New subjects among the 15 specialist surveys include "Engineering Aspects of Public Health" (London, Birmingham and Manchester, 29th June–12th July), and "Television" (London, 21st September–4th October).

P.M.G. at Cable Factory

On 21st February the Postmaster General, Earl De La Warr, visited the Telcon Works, Greenwich, of the Telegraph Construction & Maintenance Co., Ltd., including the plant of Submarine Cables, Ltd., owned jointly by Telcon and Siemens Brothers & Co., Ltd., which is housed at Telcon Works. The Postmaster General was accompanied by Mr. B. L. Barnett, Deputy Director General, Dr. W. G. Radley, C.B.E., Engineer-in-Chief, and Mr. J. T. Baldry, Principal Private Secretary to the Postmaster General. The party was received by Mr. J. N. Dean, managing director, and Mr. F. A. Lawson, chairman, of Submarine Cables, Ltd., Mr. W. F. Randall, Dr. E. W. Smith and Mr. J. Innes, directors of Telcon, Mr. F. Leighton, works manager, and several members of the staff. The Postmaster General was impressed by the manufacturing facilities for plastic insulated communication cables both for submarine and overland operation, and the general layout of the factory. The party was afterwards entertained to lunch at the works.

Crawley Factory Extension

Although as an industrial concern Bowthorpe Holdings, Ltd., is still comparatively young, its expansion has been considerable. A definite stage in this progress was marked last week by the official opening of the new administrative building which has been erected at Crawley for the company and its subsidiaries, Hellermann Electric, Ltd., Bowthorpe Electric Co., Ltd., and Bowthorpe Engineering Co., Ltd. The opening ceremony was performed by Mr. O. W. Puckey, Deputy Controller of Supplies, Ministry of Supply, in the presence of a large gathering, consisting mainly, as Mr. J. Bowthorpe, chairman and managing director, put it when introducing Mr. Puckey, of "those to whom we sell our products and those from whom we buy our raw materials." The new block is at the west end of the factory buildings

Above: **New administrative block at the Bowthorpe factory.**

Left: **Compact layout of injection and other moulding machines in the Plastics Division**

and opens on to Tinsley Lane, only a few hundred yards from Gatwick Airport. Of brick construction the unadorned building affords outside an impression of dignity and solidarity.

The ceremony provided an opportunity for a conducted tour round the factory, including the following sections of particular electrical interest. In the cable marker and sleeve shops we found the production and packing of the sleeves for the Hellermann binding system fascinating indeed. This system offers a rapid and simple method of binding cable ends by fitting on them high quality elastic sleeves by means of specially designed three-pronged tools. In this section we also saw some of the applications of "Helvin," a rubber-like oil, alkali and acid resistant material from which a very wide range of articles, including cable grommets and sealing glands, are produced by injection and low pressure moulding, and by dipping and spraying.

Among a comprehensive range of overhead line fittings in the Bowthorpe Engineering shops the company's simple two part (slotted bolt and nut) line tap was prominent. Above all we were impressed by the compact but excellent layout of injection and other moulding machines in the Plastic Division.

New E.A.W. Branch

At the inaugural meeting of the Medway Branch of the E.A.W. on 19th February the Mayors of the three Medway towns, the Mayor of Rochester, Coun. A. J. Anderson, J.P., and Mrs. Anderson; the Mayor of Chatham, Ald. F. H. Lawrence, and Mrs. Lawrence; and the Mayor of Gillingham, Ald. T. W. Bowman, and Mrs. Bowman, were present. The Mayor of Rochester welcomed the new Branch, which was formed under the presidency of Lady Moore, wife of Admiral Sir Henry Moore. Among the speakers were the Mayoress of Rochester; Mr. J. Smith, divisional education officer; Dame Caroline Haslett, E.A.W. Director; Mrs. G. A. Tatchell, J.P., president, Gravesend E.A.W. Branch; Lady Hacking, president, West Kent E.A.W. Branch; and Mr. H. F. Knell, J.P., M.I.E.E., Kent Sub-Area manager, S.E. Electricity Board. The chairman is Mrs. H. F. Knell; hon. secretary, Mrs. K. Taylor; and hon. treasurer, Mrs. J. Blackmore.

Research Scholarship

The Royal Technical College, Glasgow, announces the gift by the Belmos Co., Ltd., of a research scholarship in electrical engineering, of the value of £300 per annum, to enable a student of outstanding merit to take a course of postgraduate study and research in switching and allied problems.

High-Speed Grill

A Swiss-made grill, which after a warming up period of 20–25 minutes is claimed to cook toast or steak in ½ minute, cutlets and sausages in 2 minutes and poultry in 3–4 minutes, is now being marketed in this country by E. Whitmont & Co., Ltd., 19, Acol Court, London, N.W.6. Measuring 9§in by 8¼in by 6in, the "Ultra-grill," as it is called, is finished in vitreous enamel, the alloy grill plates being specially finished to prevent food sticking to them. The elements, loaded at 1,200 W, are thermostatically controlled. Effective heat insulation enables the grill to be used safely on any surface. Including two frame inserts the price is 19 gns.

The "Ultra-grill"

Trolley-buses in Adelaide

In Adelaide, capital of South Australia, trolley-buses have been in operation for a number of years as part of a co-ordinated road transport system which includes trams and motor-buses. To provide for new trolley-bus routes an additional thirty vehicles were ordered in 1950 from the Sunbeam Trolley-bus Co. These were shipped to Adelaide as chassis, complete with electrical equipment supplied by the British Thomson-Houston Co., Ltd. The single deck bodies have been built in Adelaide by Lawtons and the first of the new fleet has recently gone into service.

The electrical equipment includes a motor with a one-hour rating of 115 h.p. at 550 V. It is designed to maintain a schedule speed of 16 m.p.h. assuming an initial acceleration of 3 m.p.h. per second, with five stops per mile, and a 44-seater bus weighing, with normal load, 11¼ tons. The motor is of the compound-wound non-regenerative type and stabilized rheostatic braking is provided. It is usual on buses with a front entrance to mount the control panels on the chassis or at the rear, but in this instance it has been possible to arrange for the panels to be in the cab, thus giving improved accessibility and simplified maintenance. These

Sunbeam trolley-buses are generally similar to the fifty which have recently gone into service at Perth and the thirty at Brisbane; all have B.T.H. electrical equipment.

Circuit Breaker Demonstrations

Following the demonstration of their miniature circuit breaker in London last November, Dorman & Smith, Ltd., are giving four further demonstrations in Glasgow on 18th and 19th March. Invitations have been limited to the seating accommodation available, but a certain number of invitations have been reserved for interested persons who care to apply to the company's office, Ordsal Electrical Works, Salford, Manchester, 5.

Scrap Lead

The Minister of Supply has made an Order (the Non-Ferrous Metals Prices (No. 9 Order) (Amendment) Order, 1952—Statutory Instrument, 1952, No. 333) removing price control from remelted and scrap lead. Supplies of these materials have recently increased and are now sufficient to meet all demands from consuming industries.

Steel Prices Increased

The Minister of Supply, Mr. Duncan Sandys, announced in the House of Commons on Monday that he had authorized increases in the maximum prices of iron and steel to take effect from 26th February. The increases would average about £4 per ton and were necessitated by the rise in the industry's production costs.

Safety of Electric Fires

The General Electric Co., Ltd., has decided, in the interests of public safety, to make all fires manufactured by the company conform to the new British Standard (B.S. 1670: 1951) which sets out the safety requirements of electric fires. The fires will therefore, as circumstances permit, be fitted with special guards as an integral part of the fire. In the meantime guards which comply with this specification are available as optional extras for fitting to the existing range of electric fires produced by the company. A special fire has been designed for use in the nursery and for aged people.

Lighting in Printing

An 18-page technical brochure on lighting in the printing industry has just been made available by the E.L.M.A. Lighting Service Bureau, 2, Savoy Hill, London, W.C.2. This Technical Supplement 6 deals with illumination in all sections of the printing industry and is designed with the object of assisting both lighting engineers and printers in the provision of good lighting.

Electron Microscope

An electron microscope capable of magnification of 100,000 diameters has been installed in the Royal Technical College, Glasgow. It will be used in the applied physics course. With this new unit the College will be able to undertake research work on the action of dyes, the deposition of atoms in high vacua, the structure of metals and textiles, and in similar work. By the use of this Metropolitan-Vickers instrument images are transmitted through a system of lenses on to a wall screen similar to that of a television tube. The resultant image can be photographed.

Machine Shop Lighting

The neat appearance which can be provided by a lighting installation when applied to a symmetrical plant arrangement is shown in the accompanying picture. In this well-lit Turning Department in the new Sundon 3 Factory of the Skefko Ball Bearing Co., Ltd., Luton, the rows of Benjamin "Flurolier" reflectors are all placed in correct relationship to the actual machines and whilst the main illumination is directed downwards, sufficient upward light is

Benjamin "Flurolier" reflectors in the Turning Department of the Skefko Ball Bearing Co., Ltd.

prov[illegible]d to prevent any tunnel effect by clear[illegible]defining the roof structure.

T[illegible]nstallation consists of a large number of twin[illegible]80 W reflectors finished in "Crysteel" vitre[illegible]s enamel. The general construction of this [illegible]ing conforms to the Benjamin basic plan, and [illegible]n two parts—a top wiring channel and a dete[illegible]able reflector providing the usual 70 deg tra[illegible]rse cut-off. A special feature is the seri[illegible]of fins on the lower edges of the slots to give horizontal cut-off to the upward light. The [illegible]ectrical contractors for the installation were [illegible]ashleigh Phipps & Co., Ltd.

Prices of Materials

In the accompanying table we give the prices of [illegible] more important materials used in the electrical industry. The figures are those quoted on Monday last.

ALUMINIUM Ingots	ton £148 0s 0d
COPPER, H.C. Electro	ton £227 0s 0d
Fire Refined 99·7 per cent ..	ton £226 0s 0d
Fire Refined 99·2 per cent ..	ton £225 10s 0d
COPPER Tubes	lb 2s 2d
Sheet	ton £280 0s 0d
H.C. wire and strip	ton £254 0s 0d
LEAD, English	ton £171 10s 0d
Foreign	ton £170 0s 0d
MERCURY	flask £73 10s 0d
TIN	ton £975 0s 0d
ZINC, G.O.B. Foreign	ton £190 0s 0d
Electrolytic	ton £194 0s 0d
BRASS Tubes	lb 2s 1d
Sheet	lb 2s 4½d
Wire	lb 2s 7½d
PHOSPHOR BRONZE	
Wire	lb 3s 7½d
RUBBER, No. 1 R.S.S. spot ..	lb 32½d–33½d

Trade Announcements

Mr. L. J. W. Bass has been appointed representative for **Ekco-Ensign Electric, Ltd.**, covering the eastern postal districts of London and certain parts of Essex. He will operate from the head office at Preston House, 45, Essex Street, Strand, London, W.C.2.

The northern sales office of **Warerite, Ltd.**, is now the Royal Exchange, Manchester, 2 (telephone : Blackfriars 5174). The northern sales office of **Bakelite, Ltd.**, has also removed to this address.

Hawnt & Co., 59, Moor Street, Birmingham, 4, have been appointed agents for the Birmingham area for **Isotope Developments, Ltd.**, including the following counties :—Shropshire, Leicestershire, Herefordshire, Nottinghamshire, Worcestershire, Northamptonshire, Staffordshire, Rutland, Warwickshire, Lincolnshire and Derbyshire (except the portion lying north of a line through Bakewell and Chesterfield).

Truvox, Ltd., announces that the Truvox sales organization covering Great Britain, but excluding Eire, will handle the sales of Rola and Celestion unit loudspeakers and Truvox public address equipment to the wholesale trade. Service enquiries and loudspeakers for servicing should be addressed to Truvox, Ltd. (Service Department), 328, The Broadway, Harrow, Middx. (telephone : Harrow 4455).

Sellers of Leeds, engineers and merchants, 46, Park Square, Leeds, have recently been appointed official stockists of electric motors in the Leeds area by **Newman Industries, Ltd.**, Yate, Bristol.

Mr. J. P. Dawson, of Glasgow, has been appointed Scottish agent of the **Agro Electrical Co., Ltd.**, as from 1st March.

Crypto, Ltd., announce that their London north area sales office will now operate from new premises at 105, Uxbridge Road, London, W.5 (telephone : Ealing 8042). The Crypto Service Branch for the whole London area is now also at this address.

Generating Plant Sizes

In our report of the discussion on the I.E.E. paper on this subject by Messrs. Bryan Donkin and P. H. Margen (*Electrical Review*, 8th February) the remarks of Mr. J. A. C. King were wrongly attributed to Mr. J. A. B. King. Both are associate members of the Institution. We regret the error.

Catalogues and Lists

Oxford University Press, Amen House, London, E.C.4.—Science Catalogue—books for the scientist and mathematicians.

Benjamin Electric, Ltd., Brantwood Road, Tottenham, London, N.17.—Illustrated booklet on Benjamin "Crysteel" vitreous enamel.

Air Control Installations, Ltd., Ruislip, Middlesex.—Illustrated booklet on "What We Make" (G512), and folder on the "Rotoclone" system of dust control (R514).

George Turnock, Ltd., Tunion Works, Navigation Street, Walsall.—Electrical accessories catalogue illustrating the "Tunion" range of products (11150/1) and price schedule.

Hellermann Electric, Ltd., Tinsley Lane, Crawley, Sussex.—Illustrated leaflet describing the Hellermann "P" clips (BH.30).

Benham & Sons, Ltd., 66, Wigmore Street, London, W.1.—Illustrated priced folder dealing with the new "Hyco" electric roll cutting machine.

Monsanto Chemicals, Ltd., Allington House, Allington Street, London, S.W.1.—Illustrated booklet describing the manufacture and uses of "Lustrex"—Monsanto's improved polystyrene.

Davidson & Co., Ltd., Sirocco Engineering Works, Belfast, Northern Ireland.—Illustrated technical publication describing "Sirocco" pneumatic conveying installations (SF400).

Prevention of Accidents

Precautions in Factories

TWO reference handbooks published by the Royal Society for the Prevention of Accidents (52, Grosvenor Gardens, London, S.W.1) should prove a great boon to those responsible in any way for the safety of workers in factories and in building construction. Both were originally compiled in 1949 for private circulation among supervisors in Imperial Chemical Industries, Ltd., which has consented to the wider circulation now given them in a form which embodies certain improvements based upon experience in use and brings the text up-to-date.

Having regard to the onus imposed on occupiers of industrial premises, their agents and technical advisers, and also on manufacturers and sellers of apparatus, to be fully conversant with the complexities of the Factory Acts and their numerous ancillary regulations, these guides are to be recommended as time savers in providing answers to the legislative problems likely to be encountered.

Legal interpretation or advice on compliance with regulations are not within the terms of reference, but definitions, direct requirements, exceptions and exemptions are clearly and precisely set out in several sections. In each section the full titles of the relevant Statutory Instruments are given with marginal references to the appropriate sections and sub-sections of the Acts or to the regulations concerned. The convenient grouping of requirements under various headings enables the legislation governing each to be studied as a whole. With the system of indexing and cross-indexing adopted the general layout of the handbooks may well prove a model for others of a similar nature.

The first of these books, entitled "A Guide to the Principal Safety Requirements of the Factories Acts, 1937 and 1948," contains 90 pages and costs 15s net. It is divided into fifteen sections covering such items as safe access, lifting gear, prime movers and other machinery, boilers, steam, air and other receivers, dust and fumes, fire and explosion, eye protection and the employment of women and children.

The second book, "A Complete Guide to the Building (Safety, Health and Welfare) Regulations, Statutory Instrument, 1948, No. 1145" (104 pages, 15s net), should be especially useful to the safety advisers, who have now to be appointed under the Regulations. The Statutory Instrument applies to all building operations undertaken commercially, or on behalf of the Crown, or any public authority. The Regulations have what is possibly the widest application in industry of any made under the Factory Acts. This Guide is divided into seventeen sections.

BOOKS RECOMMENDED BY

ELECTRICAL REVIEW

DOMESTIC WATER HEATING
Basic Engineering Principles of Electric and Solid-Fuel Installations
By Ronald Grierson, M.I.E.E., M.I.Mech.E.
25s. net. By post 25s. 7d.

ELECTRIC-MOTOR CONTROL GEAR
Starting, Protection and Speed
By J. L. Watts, A.M.I.E.E.
5s. net. By post 5s. 3d.

STEELS IN MODERN INDUSTRY
A Comprehensive Survey by 29 Specialist Contributors
General Editor, W. E. Benbow
42s. net. By post 43s.

PLASTICS PROGRESS
Papers and Discussions at British Plastics Convention, 1951
50s. net. By post 51s. 3d.

RADIO LABORATORY HANDBOOK
By M. G. Scroggie, B.Sc., M.I.E.E.
5th Edition 15s. net. By post 15s. 5d.

MICROPHONES
A B.B.C. Engineering Training Manual. By the Staff of Engineering Training Dept., B.B.C.
15s. net. By post 15s. 5d.

TELEVISION RECEIVING EQUIPMENT
By W. T. Cocking, M.I.E.E.
3rd Edition 18s. net. By post 18s. 8d.

HARDFACING BY WELDING
By M. Riddihough, M.Met., A.R.I.C., F.I.M.
8s. 6d. net. By post 8s. 10d.

Obtainable at all booksellers or direct from:
The Publishing Dept., Dorset House, Stamford Street, London, S.E.1

Grain Drying

Advantages of Electrical Methods

In a paper entitled "Grain Drying by Electricity," presented to the Southern Centre of the Institution of Electrical Engineers at Southampton, Mr. William Cowie, A.M.I.E.E., M.I.B.A.E., of the General Electric Co., Ltd., says experience has indicated that for storage, the moisture content of the grain should not exceed the following figures, although these would be influenced by the cleanliness and type of grain, and also by storage conditions.

	Bulk per cent	Sack per cent
Where grain will be left several months	14	14–16
Where grain will be left not longer than a month	14–16	16–18

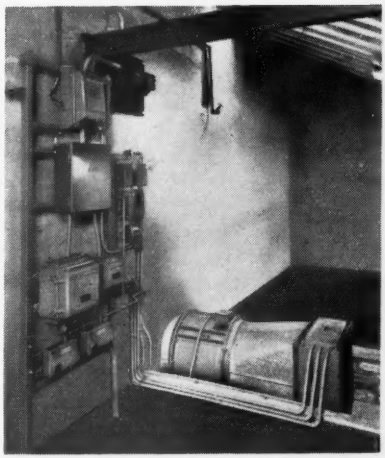
The importance of obtaining a representative average sample of the grain cannot be over-emphasized.

Continuous dryers, by the use of forced blasts of hot air, extract the moisture at the rate of about 6 per cent per hour. The maximum safe air temperatures are:—

Feeding grain for home consumption ..	180 deg F
Wheat for milling	150 deg F
Barley and seed corn up to 24 per cent moisture content	120 deg F
Barley and seed corn over 24 per cent moisture content	110 deg F

In-bin grain drying relies on changes of the "grain atmosphere" and on the fact that grain continually exposed to moving air will ultimately attain a moisture content in equilibrium with the relative humidity of that air. The relationship is still the subject of investigation and grain at 14 per cent moisture content is probably in equilibrium with air at 60 per cent relative humidity.

For prolonged bulk storage of grain, a moisture content of 14 per cent or less is required, and the bulk of grain would, therefore, be ventilated with air at an average relative humidity of 60 per cent. In this country, this condition can generally be achieved by raising the air temperature by an average of 10 deg F. When blowing fewer than the maximum number of bins a 10 deg F rise will be obtained with only part of the heating load.



This 40 sack grain dryer with a 24in "Aerofoil" fan has a total loading of 36 kW

The air speed in the ducts should be below 2,000 ft/min and there should be a gradual change in duct section area between the fan and the main air duct, and between the main air duct and air chamber beneath the bin false floors. The air speed at the floor of the bin should be 10–15 cu ft/min. Care should be taken to avoid over-drying.

This in-bin method of grain drying is not a critical or precise operation and does not demand constant attention. The drying rate cannot be accurately forecast as it will vary with the weather at harvest time, the condition of the grain and the rate of harvesting. The number of bins in use and the depth of grain will affect the air speed through the bin and also the drying rate. When dealing with grain in sacks the minimum number of sack holes would be influenced by the design of the in-bin plant.

Up to 21 per cent moisture content, the maximum grain depth during drying in a simple ventilated bin installation should not exceed 10ft although, after drying, the grain can be bulked and stored to a greater depth.

Above 21 per cent moisture content the grain depth should be reduced.

The most convenient means of giving the desired temperature rise to the air is provided by electric duct air heaters mounted on the air intake side of the fan. The installation would generally be rated for a temperature rise of 10 deg F and a typical example of 21 kW having three sections of 3, 6 and 12 kW would permit seven degrees of heat control in 3 kW stages.

For successful in-sack drying it is important to use open weave sacks and these should not be completely filled. The aim should be to obtain a grain depth of 7 in when the sack is lying on the platform. A loosely filled sack also prevents air leaks between the sack and the opening in the platform.

Summarizing the advantages of electrical methods Mr. Cover mentions the compactness of the plant; the impossibility of the drying air becoming tainted with the products of combustion; the limitation, automatic if desired, of the maximum temperature rise; immediate heat; minimum supervision necessary; and low capital cost.

Factory Inspector's Report

THE annual report of the Chief Inspector of Factories, Mr. G. P. Barnett, for the year 1950 (Command 8445, H.M. Stationery Office, price 6s 6d net) is prefaced with comments on ways in which the inspectorate is being reduced in effectiveness through staff shortages. During the year under review only 25 new inspectors were recruited as a result of two competitions.

The number of factories then registered was 241,064, a decrease of 2,530 on the previous year. Factories in which mechanical power was used continued to increase while registered premises on which mechanical power was not used continued to decrease. The number of accidents notified totalled 193,059, of which 799 were fatal, both figures representing slight increases on the previous year. The Inspector felt some satisfaction in that the totals were about the same in spite of an increase of 200,000 in the number of workers in the manufacturing industries and the extension of the risk period because of the extra overtime worked for the rearmament programme.

The report contains special notes on the development of electrolytic plant and electronic engineering. Growth of the use of X-ray sets in industry was considerable and much more powerful plant was being used for that purpose. There was also a marked extension of the employment of radioactive isotopes, examples of which are mentioned in the report. There are also comments on the utilization of electricity in factories and the fencing of new machinery as well as a summary of the precautions desirable to minimize risks of accidents caused by electricity load shedding.

Electrical accidents, which are dealt with at some length in the report, increased very slightly but the number of fatal industrial accidents was only about one-third of the total electrocutions throughout the country.

That section of the report which deals with industrial diseases includes an examination of the incidence of fatal cases of lead poisoning. Not one of the 57 cases of lead poisoning reported during 1950 was fatal. That year was the first since lead poisoning became notifiable in 1895 in which there was no fatal case.

The report records that industry in general was paying increasing attention to lighting, both natural and artificial. The standard of electric lighting continued to improve and much of the progress in that respect was, says the report, due to the adoption of fluorescent lighting.

Illumination Design Course

THE next daytime Illumination Design Course arranged by the Lighting Service Bureau will be held from 21st to 24th April. In addition to eleven lectures on the basic principles of lighting and lamps there will be a number of lectures on individual subjects such as shops, schools, offices, homes, hospitals and public buildings.

Conditions in America

Immense Water Resources Still Untapped

A COMPREHENSIVE report (dated April, 1951) on the economic and commercial conditions in the United States prepared by members of the staff of H.M. Embassy in Washington, has just been published.* While the report deals with the development of hydro-electric resources in some detail, the references to the electrical manufacturing industry and foreign electrical trade are not so informative.

Electricity and Irrigation

Dealing with the development of the water resources, the report states that many of the schemes are combined schemes of irrigation and hydro-electric development. The vital need for integrated water and power development has become increasingly apparent in the post-war period. The most widely known development of the pre-war era was the Tennessee Valley Authority (T.V.A.). By June, 1947, Congress had appropriated $717·5 million for this scheme and constructional work has been largely completed. The Authority has a total installed generating capacity of more than 2,500,000 kW.

Another outstanding development is the Colorado River project, which has for its main structure the Hoover (Boulder) Dam. Although constructed in the early 1930's, installation of the last turbo-generators was still in progress in 1950. The four additional generators to be installed will give this plant a rated capacity of 1,330,000 kW.

The Columbia Basin project serving the Pacific North-West is a multi-purpose reclamation development. It is designed to reclaim arid land in the South Central section of the State of Washington and will ultimately produce over 2,250,000 kW. Its key feature is Grand Coulee Dam. The Central Valley project of California, built primarily to protect one of the nation's richest and most highly developed agricultural and industrial areas, will also provide electric power. Hydro-electric generators already in service at Shasta and Keswick Dams provide 450,000 kW.

The Missouri River Basin project will develop the 2,500-mile length of river systems. It will require more than 100 dams, some forty power stations and thousands of miles of canals and transmission lines. It is being built jointly by the Bureau of Reclamation and the Army Corps of Engineers, and will increase the electric power resources of the West by approximately 2,500,000 kW.

The economic growth of the Pacific North-West and some other areas has been stunted by lack of sufficient low-cost energy. It is estimated that the rivers of the United States can be harnessed to provide nearly 77 million kW of additional hydro-electric power. Western rivers alone can provide nearly 50 million kW and generate about 270,000 million kWh per annum. A new record in hydro-electric power capacity and production was established by Federal reclamation projects during the 1950 fiscal year when the installed capacity reached 3,218,400 kW and nearly 20,000 million kWh was generated.

Power Station Design

In a chapter on scientific and industrial research and development, the report refers to power station design. During the two wars, designers wishing to economize in building construction, began to leave out the customary dividing wall between the boiler house and the generating room. Since the last war, this trend has been carried further by the erection of power stations without the usual enclosing building. Experience of two years or more has been obtained from a number of stations built in the southern States and, so far as can be ascertained, they present no unusual operating difficulties. When it is realized that the building can represent 15 per cent of the total cost of a power station, the value of progress along these lines becomes obvious. Construction of a station of this type has begun on the first northern

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station at Butte, Montana, which is subject to very low temperatures, and operating details will be of considerable interest.

Electrical Manufacturing Industry

Millions of American homes now use electricity for cooking, refrigeration, water-heating and innumerable household appliances. Electrical appliances have always been popular and items such as dish washers, garbage disposal units, air conditioners, and others sell in increasing numbers. Five out of every six farms in the United States had electricity available to them at the beginning of 1949.

In the industrial field, because of the increasing cost of labour and the steady pressure for better production, the use of electrically operated automatic machinery can be expected to expand at the rate of some 5 to 7 per cent annually. At the end of 1948 (the most recent figures available) consumers numbered 40,700,000.

The demand for radio receivers, caused by scarcity during the last war, was reduced during 1946 and 1947. In the following year supply had been brought into balance with demand, and although sales in that year were less than the 1947 figure of 18,321,000, they were the second largest on record. The development of the system of frequency modulation provided a stimulus to radio sales. The value of electric lamp production during 1950 amounted to $243 million, exports being worth $9,297,000.

Telecommunications

The development of the telephone industry in the United States reached new peaks in 1950. After a record year in 1949, during which the industry installed more than 1,850,000 telephones, the Bell system alone installed more than two million telephones in 1950 and finished the year with unfilled orders for 750,000 more.

The year 1950 witnessed mounting interest in television, a further decrease in frequency modulation (FM) authorizations and applications, and a rather surprising show of strength by standard amplitude modulation (AM) broadcasting. The aggregate revenue of the aural and visual broadcasting industries in 1949 had reached $450 million even though the television broadcasting industry lost $25 million. Based on industry estimates, there were, by the end of 1950, 81 million broadcast receivers in the United States, and despite the huge gains of television, production of radio receivers, which dropped by 3[illegible] per cent between 1948 and 1949, rose sharply in 1950 and was expected to show a gain of 70 per cent for the calendar year. Output of all types of home receivers during the first six months of 1950 was reported to be 6,263,857 sets.

On 30th September, 1948, the Federal Communications Commission ceased to grant applications for new television facilities pending a study of the problems involved in operating co-channel stations at the 150 miles separation originally planned. At the end of June, 1950, there were 47 television stations licensed and 62 construction permits were outstanding. In addition there were 59 stations operating on a commercial basis under special temporary authorizations, and at the end of 1950 106 stations were providing TV programmes to 64 cities, as compared with 71 stations serving 42 cities the year before. Estimates of the number of television receivers in use in 1950 range from 7 million to 10 million.

The report refers to the dispute about colour television and says that the basic issue, apart from ordinary commercial rivalry, is between the "mechanical" system of the Columbia Broadcasting System and the "all-electronic" system of the Radio Corporation of America. Shortage of critical materials is likely to postpone the development of colour television for some time to come.

Electrical Imports

Since the end of the last war British exporters have shown a keener interest in the United States market, and as will be seen from the accompanying table they have considerably increased their exports of electrical machinery and apparatus.

MONTHLY AVERAGE IMPORT VALUES

Country of origin	1938	1949	1950
	$ (000)	$ (000)	$ (000)
Total electrical machinery and apparatus imports..	168·3	360·2	786·9
United Kingdom ..	33·6	81·2	212·0
Canada	2·3	89·9	261·7
Netherlands ..	18·7	52·1	53·8
Switzerland ..	1·5	19·5	30·4
France	18·5	7·3	28·8
Sweden	5·8	22·6	42·4
Japan	44·4	35·4	33·5
Belgium	2·2	24·0	39·3

Rebuilt Instrument Factory

Everett, Edgcumbe & Co.'s Reconstruction After Fire Damage

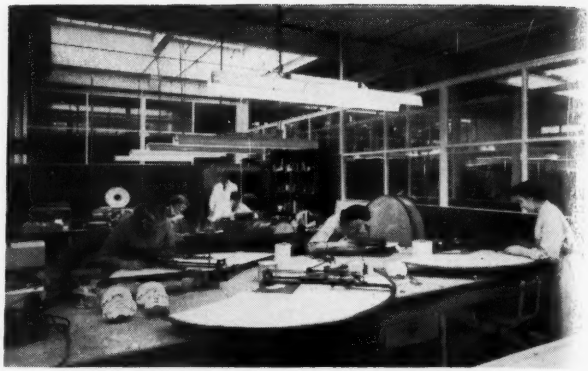
IN August, 1950, Everett, Edgcumbe & Co., Ltd., had the unfortunate experience of having 12,000 sq ft out of a total factory working area of 48,000 sq ft destroyed by fire. The test room with all test equipment was lost, together with the scaling coil winding and chart printing departments and the finished part stores including practically the whole of the stock of machined parts and part-assemblies. Minor damage was also done to the production office and some adjoining departments.

By good fortune a small works adjoining the Colindale factory was available and though the buildings were in bad condition and not entirely suited to instrument manufacture, a working area of 3,500 sq ft was made ready within a few days, benches and a few machines being installed within one week, through the help of many firms in the industry. By rearrangement of other

Above: **In the test room all the calibrating benches are provided with single- and three-phase stabilized voltage a.c. and a proportion of the benches with a d.c. supply.** *Below:* **The instrument shop**

departments, some 3,000 sq ft of operating space was available for the displaced workers. No employees were dismissed and apart from a few standing off for a few days, all were kept at work and production, though very limited, continued.

The replacement building, because of delays in obtaining the necessary licences, was not commenced until February, 1951, and the first section to be occupied was available in August of that year. From that time until the end of the year, other sections were moved in as space allowed and all departments were finally in position again in December, 1951. The small works in Cecil Road, which was used as an emergency factory, is now being repaired and modified and will eventually be used for development work and the construction of special types of instruments.



In the scale drawing section all scales after calibration are drawn on these drafting machines prior to final finishing and checking

The new building, which was of a completely new design, has a flat roof instead of the previous north lights. The roof lights have been specially designed with clerestories and the flat roof lights have prismatic glass fitted so that no direct sunlight reaches the shop floor. To save steel and also to provide an open construction, the number of stanchions, girders, joists, etc., is approximately half that in the original building. The type of construction is such that there is the minimum collection of dust and dirt, while both heat and noise insulation are provided in the roof. All lighting is of the fluorescent type, with quick-starting facilities and stability on voltage variations.

In the test room a minimum lighting intensity of 30 foot-candles is provided, either by night or day. All calibrating benches are provided with single- and three-phase stabilized voltage a.c. and a proportion of benches have also a d.c. supply. On certain benches, individual stabilized high voltage d.c. supply is fitted, giving a range of voltage up to 600 V. In the original works test room, this supply came from a battery, which has now been superseded.

All rotating machinery for the use of the test room is housed in a special room adjoining. As far as possible, machines are not run in the test room itself, but only controlled from there, thus minimizing noise and interference. Among the machines provided are frequency controlled alternators, giving a range from 15 to 3,000 c/s, some of which are automatically controlled to an accuracy of 1 part in 1,000.

Each of the benches in the instrument assembly shop is provided with tool rack, drawing rack and gas. There is a minimum illumination of 25 foot-candles. The machine tools in the assembly shop are arranged in a single line, along the wall, and multi-supplies are provided so as to facilitate re-arrangement of the equipment at any time.

The main a.c. supply to the new building is fed directly from the main distribution board to twenty-four distribution boxes, arranged so that the maximum length from the box to any point is of the order of 20ft. The trunk mains for gas and air supplies run down the central passage of the building, so as to allow of easy distribution to any department. The general steam heating system has been adapted and is used in conjunction with fan-assisted distribution units, so that there is a minimum of steam pipes in any department. A diesel standby set supplements the main electricity supply from the Eastern Electricity Board to the extent of 55 kW.

FINANCIAL SECTION

Company Notes and Stock Exchange Activities

Reports and Dividends

The Westinghouse Brake & Signal Co., Ltd., reports a consolidated trading profit for the year ended 30th September last of £707,671, as compared with £482,881 for the preceding year, from which is deducted loan and bank interest of £28,851 and taxation £348,365, leaving a consolidated net profit of £330,455 (against £228,462). Of this, minority interests account for £10,833, and £107,256 is retained by subsidiaries, leaving a net profit to the parent company of £212,366 (against £167,969), to which is added £98,112 brought in, making £310,478 available. Contingencies reserve receives £50,000. The dividend for the year is maintained at 14 per cent and £147,984 is carried forward.

A. H. Hunt (Capacitors), Ltd., report a net profit for 1951 of £58,479, as compared with £55,917 for 1950. This figure is arrived at after deducting £91,420 for taxation, but before allocating £38,357 to reserves, etc. The final ordinary dividend is 17½ per cent, making 25 per cent for the year. This is at the same rate as for the preceding year, but is paid on increased capital.

Desoutter Bros. (Holdings), Ltd., is paying a dividend of 16 per cent, less tax, on the ordinary shares for the ten months to 31st December last. The company was made public on 26th February, 1951. The group profit for the period, after providing £181,843 for taxation, is £63,203.

Taylor, Tunnicliff (Electrical Industries), Ltd., reports a group profit and sundry income, before tax, for 1951 of £452,783, as compared with £363,784 for 1950. Taxation absorbed £236,741 and £20,000 is applied to writing off goodwill. The dividend for the year is unchanged at 20 per cent and £431,765 is carried forward (against £333,472 brought in).

Electric & Musical Industries, Ltd.—Approximately 95 per cent of the " rights " to the 1,741,724 new shares offered were taken up by stockholders who also applied for 1,470,494 additional shares. Each applicant for additional shares will therefore receive only a nominal allotment.

Radio Rentals, Ltd.—Circular letters, provisional allotment letters and application forms for excess shares in connection with the issue of 100,000 additional ordinary shares of 5s each were posted on 22nd February. The shares are being offered to ordinary shareholders at the price of 10s per share on the basis of one new ordinary share for every eight ordinary shares held. Ordinary shareholders have the right to apply for a limited number of excess shares.

Associated Electrical Industries, Ltd., announces that acceptances under its offer of 2,217,649 ordinary shares of £1 each at 60s to existing stockholders totalled approximately 97 per cent. Applications for additional shares were considerably in excess of the number available. Those not exceeding 20 shares have been allotted in full, and those exceeding 20 shares have each received an allotment of 20 shares.

Electrical & Industrial Investment, Ltd., reports a net profit for 1951 of £44,322, as compared with £39,061 for 1950. The deferred ordinary dividend is 25 per cent (against 20 per cent).

Waygood-Otis, Ltd., reports a profit for 1951 of £298,780, as compared with £378,196 for 1950, from which is deducted depreciation £17,698, directors' remuneration £14,857, property, etc., replacement £45,000, and taxation £130,000. It is proposed to pay a final ordinary dividend of 25 per cent (against 15 per cent), making 55 per cent for the year (against 45 per cent). The balance carried forward is £11,720 (£14,024 brought in).

The English Electric Co., Ltd., has declared a final dividend of 10 per cent on the ordinary shares, maintaining the distribution for the year at 15 per cent. The new ordinary shares do not participate in this.

New Companies

D. R. Weir (Ewell), Ltd.—Registered 4th February. Capital £5,000. Electricians, workers and dealers in electrical and wireless apparatus, etc. Directors: D. R. Weir (permanent), J. R. Weir, Madeleine R. Hey and Audrey P. Hey. Solicitors: J. H. Hortin & Nash, 161, Edgware Road, W.2.

Collett & Smith, Ltd.—Registered 4th February. Capital £3,000. Electrical, mechanical and general engineers, etc. Directors: B. Collett, E. A. Smith and D. Cunitz. Secretary: Winifred D. Wilson. Regd. office: St. Albans Works, Lundy Street, Field Road, W.6.

Heron Heating Devices, Ltd.—Registered 4th February. Capital £500. To enter into an agreement with A. A. Heron; to acquire interests in any patents; to carry on the business of heating engineers, water supply engineers and manufacturers and dealers in electric and other apparatus, etc. Directors: A. G. Heron (permanent), Elsie F. Sadler (permanent director and chairman), J. Oliver and T. M. Sadler. Secretary: T. M. Sadler. Regd. office: 10, Snowdon Street, Newcastle-on-Tyne.

Ellison (Transformers), Ltd.—Registered 13th February. Capital £500. Retail and wholesale merchants, manufacturers and repairers of transformers, wireless apparatus and electrical instruments of all kinds, etc. Directors: J. Kleinman and C. Wesley, directors of Ellison Radio & Electrical Co., Ltd. Secretary: A. A. Malnick. Regd. office: 6, Broad Street Place, E.C.2.

Thermostatic Mixing Valve Co., Ltd.—Registered 12th February. Capital £100. General, mechanical, electrical and motor engineers, etc. Subscribers: H. W. Hollands and D. W. James. Solicitors: Duggan, Elton & James, 43, Cannon Street, Birmingham, 2.

Somnolux Electrical Products, Ltd.—Registered 8th February. Capital £5,000. Manufacturers of and dealers in electrically heated blankets, pads, sheeting, bedding and clothing; resistance wires, switches, etc. The first directors are to be appointed by the subscribers. Solicitors: Platt & Co., 4, Albert Square, Manchester, 2.

Winding-up Petition

Hale Electric Co., Ltd.—A petition for the winding-up of this company was presented to the High Court on 4th February by Harvey Electrical (Engineers), Ltd., and will be heard in London on 10th March. Any person who intends to appear on the hearing must notify Mr. L. Fior, 14, Manchester Square, London, W.1, solicitor for the petitioner, by 8th March.

Liquidation

The Midland Wireless & Electrical Appliance Co., Ltd.—Winding up voluntarily. Liquidator, Mr. H. L. Barlow, 66, Alma Street, Luton, Beds.

Bankruptcies

H. W. Daldry, lately carrying on business at 168, Bells Road, Gorleston-on-Sea, Suffolk, electrician.—Last day for receiving proofs for dividend 5th March. Trustee, Mr. F. R. D. Walter, Castle Chambers, Opie Street, Norwich. Official Receiver.

F. Jones and **B. P. Callaghan,** formerly trading in co-partnership at 2, Farm Yard, Levenshulme, Manchester, under the name of "Jones & Callaghan," electrical engineers and sheet metal workers.—Last day for receiving proofs for dividend 7th March. Trustee, Mr. F. C. Ormrod, 20, Byrom Street, Manchester, 3, Official Receiver.

TRADE MARKS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 13th March:—

W WESTINGHOUSE (design). No. B698,878, Class 7. Dynamos, welding machines, ironing machines, food mixers, dish-washing machines, elevators, lifts, hoists, and appliances for attachment to sinks for the comminution and disposal of garbage, all being electrically operated; electric generators; electric motors, electric motor-generators, diesel engines and motors, steam and gas turbines, steam and gas engines, reduction gears and gearing, none being for land vehicles; diffusion pumps, ejectors, mechanical vacuum pumps; aircraft engines, propulsion transmission mechanism for watercraft, steam and vapour condensers, air ejectors (machines), condensate pumps, circulating pumps, air pumps included in Class 7, pneumatic conveyors (machines); bearings, gear wheels and pulleys, all included in Class 7; hydraulic servo-mechanisms; winders, rewinders and reel drivers, all being machines; laundry washing machines, clothes drying machines, furnaces, boilers and heat exchangers, all being parts of machines; and parts included in Class 7. W WESTINGHOUSE (design). No. B698,879, Class 9. Electric and electronic instruments and apparatus, all included in Class 9; sound recording and sound reproducing apparatus and instruments; radio, radar, television, telephonic and telegraphic instruments and apparatus; sonic locating apparatus, steam flow meters, temperature indicating instruments, instruments and apparatus for measuring speed, thermostats, pyrometers, fluid flow meters, vacuum gauges, wind-indicating instruments, vibrometers, gyroscopes for stabilization and control purposes; and parts included in Class 9 of all the aforesaid goods. W WESTINGHOUSE (design). No. B698,880, Class 10. All goods included in Class 10. W WESTINGHOUSE (design). No. B698,881, Class 11. All goods included in Class 11.—Westinghouse Electric Corporation, East Pittsburg, Pennsylvania, U.S.A. Address for service, c/o G. Raymond Shepherd, 1–3, Regent Street, London, S.W.1.

MAGNETOPHON. No. 700,557, Class 9. Sound reproducing and sound recording apparatus. AEG (design). No. 693,123, Class 14. Electric clocks. AEG (design). No. 693,125, Class 17. Materials for electrical insulation.—Allgemeine Elektricitats-Gesellschaft, Berlin-Grunewald, Germany. Address for service, c/o S. E. Matthews, 14–18, Holborn, London, E.C.1.

COURTESY MAN. No. 702,760, Class 9. Electrically operated mechanical signs for advertising and indicating purposes.—Frantisek Mares, Aller Vale Garage and Filling Station, 32, Newton Road, Kingskerswell, near Newton Abbot, Devon.

THERASONEL. No. 703,462, Class 9. Electronic apparatus for generating supersonic pressure waves (not for medical or surgical purposes). THERASONEL. No. 703,463, Class 10. Electronic apparatus for generating supersonic pressure-waves for medical and surgical purposes.—Ateliers de Constructions Electriques de Charleroi, Brussels, Belgium. Address for service, c/o Feeny & Feeny, 2A, Charlwood Place, Westminster, S.W.1.

DIXOCLENE. No. 703,516, Class 9. Floor polishing and cleaning machines, scrubbing machines, squeegee machines, carpet cleaning machines, machines for spraying polish and carpet shampooing machines, all being electrically operated for domestic use.—R. G. Dixon & Co., Ltd., Capitol Works, Empire Way, Wembley, Middlesex.

INDOLA. No. 703,524, Class 11. Electrical hair-drying apparatus and drying caps for use therewith, apparatus for heating waving irons, electrically heated caps for use in hairdressing (not being parts of machines), apparatus for heating towels, ventilating fans and hot air apparatus for use in drying the hands.—Indola N.V. Voorburg, South-Holland, Netherlands. Address for service, c/o E. N. Lewis & Taylor, Berridge Street Chambers, 4, Berridge Street, Leicester.

STOCKS and SHARES

It is hardly necessary to say that Stock Exchange markets and business are overshadowed by the close prospect of the Budget. Postponement of the date until 11th March means an unwelcome continuance of suspense for an extra week. In advance, the general tendency throughout the House has leaned to the lower side, which is no more than natural, seeing that against the automatic sales which go on continually, for deceased accounts and other such reasons, there is little in the shape of resistance on the part of buyers. And they are awaiting the outcome of the Budget before taking a hand even in cases where prices look attractively cheap.

British Electricity Stocks

Long memories can scarcely recall a time at which British Government securities stood so far below par as many of them do now. Yields have been higher on several occasions, but usually, at such times, from stocks bearing interest above the 3 per cent rate on which a number of the issues outstanding to-day were issued. To put it simply, and ignoring redemption considerations, a rise in gilt-edged yields to a 3½ per cent basis leaves a 4 per cent loan at well over 100, but a 3 per cent loan at 86. This figure is a point or so over the present prices of the two 3 per cent British Electricity stocks. They offer, therefore, to a present buyer the certain prospect of some 15 points in tax-free capital appreciation by the time they fall due for repayment at 100.

Profits on Redemption

Repayment of the two 3 per cent British Electricity stocks will occur between 1968 and 1973 in the one case, and between 1974 and 1977 in the other. A present yield of little over 3½ per cent is not exciting, and few will be so bold as to say that the fall in gilt-edged prices has yet spent itself. All the same, the stabilizing influence of the redemption profit becomes stronger at each step. It is a factor of particular interest to super-tax payers, and one for the lack of which the "undated" stocks, such as War Loan, have suffered exceptionally badly in recent months.

Westinghouse Brake Results

Westinghouse Brake and Signal are dealing in their customarily conservative manner with another, and substantial, increase in profits during the year ended last September, the single annual distribution on the ordinary stock being repeated at 14 per cent for the ninth successive occasion. According to the preliminary statement, net group profits are up by the best part of £100,000 this time, making a disposable surplus of £320,000 to cover the amount of £82,500 to be distributed in dividend. A year ago, the balance-sheet showed reserves in excess of the £1,122,000 ordinary capital, so that the latest full accounts, due shortly, can be expected to demonstrate impressively the benefits derived from the consistent ploughing-in of profits. At 47s 6d, the price is 2s lower on the week.

Week's Price Changes

Fluctuations in prices since a week ago are mostly trifling, but there are not many rises. Burco, 20s 9d, have gained the pence, and small improvements have made E. K. Cole 15s 6d, Decca 17s, Telegraph Condensers 46s, Great Northern Telegraph £11. Amongst the falls, Revo at 32s 6d are 5s lower; Ward & Goldstone, 36s 3d, are similarly down (the fall in the latter took place some time ago, but the official quotation in the Manchester Stock Exchange List had not been altered). Siemens, 33s, and Murex, 47s, have both lost a florin. Marconi Marines are 2s 6d down at 31s 3d. There are trifling declines in Crompton Parkinson, 8s 9d, De la Rue, 20s 9d, General Electric, 57s 9d, Pye, 18s 3d, and Telephone Properties, 30s.

New Issues

Signs are that a certain amount of new investment is taking place in the three big new issues of ordinary shares made recently in the electrical equipment market by G.E.C., A.E.I., and Automatic Telephone. A.E.I. new shares are now fully paid and stand at 70s. On General Electrics and Automatic Telephones, offered respectively at 72s 6d and 45s, the premiums are about 2s and 8s 3d. Radio Rentals are quoted at 20s 9d, ex the rights to the new shares. The latter are offered at 10s and the price is about 10s 9d.

Hoover

The 5s ordinary shares of Hoover, Ltd., at 25s 3d, made a slight advance after the dividend for 1951 was declared earlier this month. In less constrained business conditions, there might have been a livelier response to the declaration and the accompanying profits figures. After tax, the net profits of the parent company are £100,000 above the previous year's, and there is a surplus of more than a million to cover the distribution of £480,000 in dividends on the equity. The ordinary shareholders receive a 35 per cent dividend which, allowing for the intervening 100 per cent capital bonus, is an increase of 5 per cent on the former payment, and puts the shares on a yield basis of £6 17s 6d per cent. On the relatively small amount of capital in "A" ordinary shares, the dividend is being raised from 208 to about 325 per cent. The "A" stand a little below the price of the ordinary, and pay over 12½ per cent on the money.

D.C. Amplifiers

Three I.E.E. Papers

AT a Measurements Section meeting of the Institution of Electrical Engineers in London last week three papers dealing with d.c. amplifiers were presented. The first of these, " The Automatic Compensation of Zero-Drift Errors in Direct-Coupled Feedback Systems," by Mr. F. A. Summerlin (Sperry Gyroscope Co., Ltd.), had already been published in the I.E.E. *Proceedings*, Vol. 98, Part II, No. 61, February, 1951. This paper shows first of all that a degenerative feedback produces no improvement in the zero-drift errors of direct-coupled amplifiers. A method is then described whereby these errors can be reduced to any desired amount by using an auxiliary amplifier. A single auxiliary amplifier, by means of suitable switching, can be used to correct continuously the balance of a number of main feedback systems. The paper discusses the effects of the balancing circuits on stability with particular reference to the case where the feedback system is a position-controlled servomechanism.

High Gain Type

The second paper, which was presented by Messrs. K. Kandiah and D. E. Brown (both of the Atomic Energy Research Establishment) deals with high gain d.c. amplifiers. Various methods of measuring small currents and voltages with particular reference to the theoretical and practical limits of such measurements are discussed. Most of the methods described use valves to amplify the signals to a level suitable for indication on a robust instrument. The more important methods of converting the signal into a modulation of a carrier frequency are described as also are the basic principles of each type of amplifier, but no attempt has been made by the authors to describe details of the circuit arrangements.

Limitations of sensitivity and frequency response of each method are discussed and the precautions necessary to obtain the best sensitivity are mentioned. The authors show that a contactor modulator and a capacitance modulator can be used to measure a voltage from a low resistance source and a current from a high resistance source, respectively, almost to the theoretical limit of random fluctuations. A direct-coupled amplifier with a contactor modulator to correct for zero drifts is the best available system when a source of medium resistance when a frequency response of a few kc/s is required.

Compact Design

The final paper to be presented at the meeting, " The Design of a Practical D.C. Amplifier Based on the Second-Harmonic Type of Magnetic Modulator," by Messrs. S. W. Noble and P. J. Baxandall, is a sequel to the paper by Prof. F. C. Williams and Mr. S. W. Noble entitled, " The Fundamental Limitations of the Second-Harmonic Type of Magnetic Modulator as Applied to the Amplification of Small D.C. Signals " (see I.E.E. *Proceedings*, 1950, Vol. 97, Part II, page 445). It describes some of the considerations involved in the design of a practical and compact d.c. amplifier based on the previous work with particular reference to an instrument designed and built at the Telecommunications Research Establishment.

The paper includes a description of the following items which were not considered in the previous paper: a 1,500 c/s oscillator of relatively simple design giving less than 0·0005 per cent second-harmonic distortion; a low-pass filter to prevent power from the oscillator reaching the input d.c. signal source; a phase-sensitive rectifier of unusual design; and arrangements for range switching to cover a wide extent of signal inputs.

Considerable attention is devoted to the problem of applying overall d.c. negative feedback to the amplifier, which necessitates careful design of several sections of the equipment from the point of view of their gain and phase characteristics. The results of tests and measurements carried out on the completed equipment are also given in the paper.

ELECTRICITY SUPPLY

Higher Bulk Supply Charges

Development Plans in Ireland

THE British Electricity Authority announces that, because of continuing rises in costs, prices of electricity to the Electricity Boards will be increased as from 1st April. On that date the kW demand charge under the tariff fixed with effect from 1st April, 1951, will be increased from £4 2s 6d to £4 5s 6d. The running charge remains at 0·33d kWh, subject to a coal price adjustment of 0·0007d per 1d variation in the price of fuel in the respective Areas from a basic figure of 38s a ton.

South Wales Tariffs

Recently the South Wales Electricity Board announced proposals for standardizing the tariffs in its Area (*Electrical Review*, 8th February, page 305). It was then stated that revisions for dealing with increased costs would be submitted shortly, it being considered desirable to keep these separate from standardization. In a memorandum which was discussed by the Consultative Council last week the Board explained that the 4s a ton rise in the price of coal would add £112,000 to the Board's costs in 1952–53 and £128,000 in 1953–54, after allowing for additional revenue under coal clauses. Raising of the Central Authority's bulk supply m.d. charge by 3s/kW in 1952–53 and by 5s kW in 1953–54 would result in increased expenditure of £99,000 and £178,000 in the two years, while higher wages would add £100,000 a year. To meet these costs the Board proposed the following revisions:—

DOMESTIC AND COMMERCIAL BLOCK RATE TARIFFS. Increase in primary charge from 4½d to 5d/kWh.

COMMERCIAL MAXIMUM DEMAND TARIFF. Kilowatt charge to be raised from £5 12s 6d to £5 17s 6d a year.

INDUSTRIAL BLOCK RATE. No variation, as the standard tariff is estimated to result in an increase in revenue of about 20 per cent.

INDUSTRIAL MAXIMUM DEMAND RATE. For m.v. and l.v. supplies, increase in kW charge from £5 12s 6d to £5 17s 6d a year or from 11s to 11s 6d a month. For h.v. supplies, increase from £5 2s 6d to £5 7s 6d a year or from 10s to 10s 6d a month.

The proposals were estimated to bring in an additional revenue of £302,000 in 1952–53. In 1953–54 the increase in revenue was expected to be £351,000.

Height of 275 kV Line

Stockton-on-Tees Town Council has been informed that approval has been given to the proposed route in County Durham of a new 275 kV transmission line for the British Electricity Authority. In March, 1951, the B.E.A., in reply to representations by the Council, stated that in areas where the Council could give a reasonable assurance that developments were proposed the Authority would erect the towers carrying the line high enough to permit building under the conductors. Planning permission has now been given, however, without any conditions as to the height of the line and the Council is to approach the B.E.A. on this point.

Pumped Storage in America

One of the first major installations in the United States in which the same unit will be used for both pumping and generating electricity is to be installed at the Flatiron station now being constructed in north-east Colorado.

According to the *Electrical World* the turbine will be a vertical-shaft, single impeller centrifugal machine with fixed vane diffuser-type spiral casing. Total heads will range from 170 to 297ft for pumping and from 140 to 290ft for generation. There will not be any governor, but a butterfly valve in the penstock may be controlled manually for synchronizing the generator (8,500 kW at 13·8 kV and 300 r.p.m.) with the system. The station will also contain two conventional generators of 31,500 kW driven by Francis turbines at 514 r.p.m.

Irish Electricity Bill

Moving the second stage of the Electricity (Supply) (Amendment) Bill in the Dail, Ireland, on 13th February, Mr. Lemass, Minister for Industry and Commerce, stated that the purpose was to raise the advances to the Electricity Supply Board by £22,000,000 from the present limit of £36,945,000. It was estimated that this would meet the Board's requirements until 1955. Of the additional amount, £12,500,000 would be spent on increased generation, £4,000,000 on the extension programme, and £4,000,000 on distribution, with £1,500,000 for contingencies.

The Board estimated that the demand for electricity would double itself in the next five years and would increase by as much again in the following five years. This year the demand would probably reach 1,075 million kWh while the potential output was 1,140 million kWh though exceptional conditions might cause a

period of difficulty. The position at the end of the next five years—taking into account the new turf-burning plant—was that the Board's output would have doubled to 2,084 million kWh. Plans for the ensuing five years were under way. Besides an additional generating set at Ardnacrusha, it was proposed to develop the Avonmore and Clady Rivers and perhaps the Boyne. Other projects were designed to burn turf. The Ferbane station would be ready by 1956 with two generating sets and it was contemplated that two additional sets would be added. Portarlington station would be extended so as to produce another 45 million kWh annually and there would be further development at Bangor Erris involving the construction of two more sets with a combined annual output of 160 million kWh. Another turf-burning station would be established in the Edenderry–Daingean area and one was included in the programme for Mayo, east of Ballina.

The Board had difficulty in planning these developments because of staff shortage and at the Minister's suggestion it was considering entrusting planning and the placing of construction contracts with private commercial firms. The full generating programme, if completed within the specified period, would be just enough to meet the anticipated demand ten years hence, but it left no margin, and he would have to discuss with the Board what additions could be made.

Discussing rural electrification, he said that this work had been accelerated in 1951, but the Board was now encountering difficulties through shortage of technical staff and equipment. Only 20 per cent of the scheme had been completed to date. In the light of experience it was now obvious that the original estimate of the cost must be increased; on the basis of present prices the figure would be about £24½ million.

First Australian 220 kV Line

Work is in progress, states the *Electrical Engineer and Merchandiser* (Melbourne), on the first transmission line in Australia designed to operate at 220 kV. It will transmit power from the Kiewa hydro-electric scheme of the Victorian State Electricity Commission to Melbourne and will be 152 miles long. The longest span—more than 1¼ miles—will be at the crossing of the Eildon reservoir.

Belfast Trolley-bus Route Extension

On 18th February an extension of the Belfast Corporation trolley-bus route between its original terminus on the Shore Road to Merville Garden Village 300 yards distant was formally inaugurated.

Electrical Installations

Grantham Town Council is to install electricity in 64 houses in Turnor Crescent (estimated cost £1,329), subject to each tenant agreeing to pay additional rent of 6d a week.

STREET LIGHTING NOTES

BLACKBURN Town Council has approved the setting up of a street lighting maintenance department, the appointment of a chief electrical assistant at £645–£710 a year, and a maintenance and supervising inspector at £500–£560 a year. The new department will deal with electric and gas street lighting and electrical maintenance work.

COVENTRY Road Safety Committee recommends a revised scheme for the relighting of approximately 9 miles of classified roads and bus routes. The estimated cost of the scheme, which involves the provision and erection of approximately 344 lamps, the removal of existing standards and reinstatements, amounts to £17,888.

WEST BRIDGFORD U.D.C. has approved a scheme estimated to cost £1,253 for the provision of sodium street lighting in Davies Road.

A scheme for replacement of more than 400 gas lamps at WIGSTON (Leics) by 500 electric street lamps is to be submitted to the Ministry of Transport. The first instalment will cover the main roads.

EARLS BARTON (Northants) Parish Council is to proceed with the conversion of the street lighting system from gas to electricity.

COCKERMOUTH (Cumberland) U.D.C. has agreed to the installation of electric lighting in Slatefell Drive, Mosser Avenue, Woodside Avenue, Sunscales Avenue and Towers Lane.

WHITEHAVEN Corporation proposes to carry out a scheme for the installation of fluorescent and mercury vapour lighting in various streets at an estimated cost of £17,887.

Experimental floodlighting of "zebra" crossing outside Catford Town Hall by means of 140 W sodium lamps in G.E.C. lanterns suspended from existing lighting columns

NEXT WEEK'S EVENTS

Monday, 3rd March

BIRMINGHAM.—James Watt Memorial Institute, 6 p.m. I.E.E. South Midland Centre. "Domestic Electrical Installations: Some Safety Aspects," by H. W. Swann. "Earth-Leakage Protection in Parallel with Solid Earths," by N. Elliott.

ILFORD.—Angel Hotel, 8 p.m. A.S.E.E. North-East London Branch. Lecture by H. E. J. Butler.

LEEDS.—Great Northern Hotel, Wellington Street, 7.30 p.m. A.S.E.E. Leeds Branch. "The Factories Act Regulations and the Supervising Electrical Engineer," by W. Fordham Cooper.

MAIDSTONE.—New Inn, Sandling Road, 7.30 p.m. Institution of Electrical Engineers. District meeting. Film on "Overhead Line Construction."

NEWCASTLE-ON-TYNE.—King's College, 6.15 p.m. I.E.E. North-Eastern Centre. "The Application of Transductors as Relays to Protective Gear," by R. K. Edgley and F. L. Hamilton. (Joint meeting with the Radio & Measurements Group.)

Tuesday, 4th March

HAMMERSMITH.—Windsor Castle Hotel, 134, King Street, 7.30 p.m. A.S.E.E. West London Branch. "Main Line Traction," by C. C. H. Wade.

LIVERPOOL.—Merseyside & N. Wales Electricity Board Service Centre, Whitechapel, 6 p.m. I.E.S. Liverpool Centre. "Lighting and Safety in Factories," by L. C. Rettig. (Joint meeting with the Association of Production Engineers, Factory Inspectors, and Works Managers' Association.)

LONDON.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Measurements Section. Discussion on "Design of Control Panels including Instrument Scales and Pointers," opened by L. B. S. Golds and H. Murrell.

MANCHESTER.—Engineers' Club, Albert Square, 6.15 p.m. I.E.E. North-Western Centre. "The Economics of Low-Voltage Electricity Supplies to New Housing Estates," by F. G. Copland.

NEWPORT.—Town Hall. I.E.S. Cardiff Centre. E.A.W. Quiz on Electrical Problems in the Home.

Tuesday, 4th March, to Saturday, 29th March

LONDON.—Olympia. *Daily Mail* Ideal Home Exhibition.

Wednesday, 5th March

BIRMINGHAM.—James Watt Memorial Institute, Great Charles Street, 7 p.m. Junior Institution of Engineers, Midland Section. Presidential Address by Air Commodore F. R. Banks on "Enterprise in Engineering."

BRISTOL.—Electricity House, 7 p.m. I.E.E. Bristol Students' Section. Joint Brains Trust with Graduates' Section, I.Mech.E.

EDINBURGH.—Heriot-Watt College, 7 p.m. I.E.E. Scottish Centre. "Instruments for use in the Microwave Band," by Dr. A. F. Harvey.

MIDDLESBROUGH.—Cleveland Scientific & Technical Institute, Corporation Road, 6.30 p.m. I.E.E. Tees-Side Sub-Centre. "The Economics of Low-Voltage Electricity Supplies to New Housing Estates," by F. G. Copland.

NEWCASTLE-ON-TYNE.—Minor Durrant Hall, Oxford Street, 6.15 p.m. I.E.S. Newcastle Centre. "Colour and Light," by G. Ellis.

RUGBY.—College of Technology & Arts, 6.30 p.m. I.E.E. Rugby Sub-Centre. "Technical Colleges and Education for the Electrical Industry," by Dr. H. L. Haslegrave. (Joint meeting with South Midland Education Discussion Circle and the Rugby Students' Section.)

SHEFFIELD.—Royal Victoria Station Hotel, 7.30 p.m. A.S.E.E. Sheffield Branch. "Sound and Sound Recording," by C. L. Bunce.

SOUTHSEA.—Royal Beach Hotel, 6.30 p.m. I.E.E. Southern Centre "Electricity Supply—A Statistical Approach to some particular Problems," by R. B. Rowson.

YORK.—Creamery Restaurant, Pavement, 7.30 p.m. A.S.E.E. York Branch. Film evening, presented by R. Spence.

Thursday, 6th March

CARDIFF.—At the South Wales Institute of Engineers, 6 p.m. Association of Mining Electrical & Mechanical Engineers, S. Wales Branch. "Some Notes on the Standardization of Switchgear," by V. W. Lowe and J. Vaughan Harries.

CROYDON.—Café Royal, North End, 8 p.m. A.S.E.E. South London Branch. Film evening.

LONDON.—Savoy Place, W.C.2, 5.30 p.m. Institution of Electrical Engineers. "Post-Graduate Activities in Electrical Engineering," by W. J. Gibbs, D. Edmundson, R. G. A. Dimmick and G. S. C. Lucas. Discussion to be opened by Prof. Willis Jackson.

I.E.E. London Students' Section, 6.30 p.m. Visit to the Radio Terminal, Brent.

At the Institution of Mechanical Engineers, Storey's Gate, S.W.1, 6 p.m. Institution of Heating & Ventilating Engineers. Symposium on Church Heating.

At the Royal Society of Arts, John Adam Street, Adelphi, W.C.2, 6 p.m. Institution of Engineering Inspection. "Glass in Engineering," by P. M. Davidson.

NOTTINGHAM.—E.M.E.B. Smithy Row, 5.30 p.m. I.E.S. Nottingham Centre. "Invisible Radiations from Illuminants," by B. S. Cooper.

TORQUAY.—Electricity Offices, 3 p.m. I.E.E. South-Western Sub-Centre. "The Protection of Electrical Power Systems—A Critical Review of Present-Day Practice and Recent Progress," by H. Leyburn and C. H. W. Lackey.

TYTHING.—Talbot Hotel, 7.15 p.m. Worcester Electric Club. "Electricity Supply in America," by R. Mallet.

Friday, 7th March

BATH.—S.W.E.B. Lecture Theatre, Old Bridge, 7 p.m. I.E.S. Bath & Bristol Centre. "Sodium Lamps and their Applications," by A. W. Gostt.

BIRMINGHAM.—Grand Hotel, 6.30 for 7 p.m. Birmingham Electric Club. Annual dinner.

[*Continued on next page*

Next Week's Events. Friday, 7th March (*Continued*)

BRISTOL.—Grand Hotel, 7.30 p.m. A.S.E.E. Bristol Branch. "Electricity in Agriculture," by W. Cover.

COLCHESTER.—George Hotel, 6.45 for 7.15 p.m. Ipswich & District Electrical Association. Annual dinner.

LIVERPOOL.—Laboratories of Applied Electricity, Brownlow Street, 7.30 p.m. A.S.E.E. Liverpool Branch. "The Cathode Ray Oscillograph as a Tool." Reece's Restaurant, Parker Street, 7 p.m. I.E.E. Mersey and North Wales Centre. Dinner-dance.

LONDON.—Connaught Rooms, Great Queen Street, W.C.2, 12.15 for 1 p.m. Electrical Trades Commercial Travellers' Association. Annual luncheon. (Postponed from 15th February.)

NEWCASTLE-ON-TYNE.—King's College, 6.30 p.m. I.E.E. North-Eastern Students' Section. "Some Experiments on Heat Transfer in Fluids," by . E. Western.

NOTTINGHAM.—Victoria Station Hotel, 6.4 for 7.15 p.m. I.E.E. East Midland Centre. A ual dinner.

STOKE-ON-TRENT.—M.E.B. Service Centre, ngs-way, 7 p.m. E.P.E.A. Midland Technical oup. A paper on the visit of the British team to An ican Electricity Supply Industries.

STONE.—Crown Hotel, 7 p.m. I.E.E. orth Staffordshire Sub-Centre. "Generation and low of Harmonics in Transmission Systems," b Dr. S. Whitehead and Dr. W. G. Radley.

JAPANESE ELECTRICAL INDUSTRY

OVER fifty different countries figured as destinations of Japanese electrical material last year. Already in 1950 a wide range of such goods had been gradually entering the export trade. Included were generators and motors recorded in the official statistics in five classifications by weight, namely, (1) not over 25 kg, (2) not over 100 kg, (3) not over 500 kg, (4) not over 5,000 kg. and (5) over 5,000 kg; together with rotary convertors, transformers up to 1,000 kg and mercury and other rectifiers. Among lighter apparatus there were fans, magnetos, condensers, switchgear, telephone equipment and all kinds of meters, measuring and testing devices, lamps, batteries and radio material.

It is not possible to give values for the export distribution of all the various items that make up Japan's revived electrical trade, but totals and some of the leading destinations of the main groups during the first nine months of 1951 are shown. In the table below details are given of the monthly average production in 1950 and the first ten months of 1951 of some of the country's leading electrical manufactures, the figures being in units unless otherwise stated.

MONTHLY AVERAGE PRODUCTION

Class of Equipment	1950	Jan.-Oct., 1951
Electric locomotives	3	3
Electric vehicles	76	11
Standard motors	23,062	27,565
Standard transformers	7,179	10,500
Generators a.c.	67	58
Generators d.c.	341	339
Mercury-arc rectifiers	105	68
Power condensers	11,785	17,000
Circuit breakers	766	1,550
Fans	9,900	14,350
Wattmeters	132,720	142,350
Light bulbs (thousands)	13,296	19,900
Radio receivers	23,952	31,550
Radio transmitters	149	301
Insulators (tons)	2,972	3,500

VALUE OF EXPORTS

Class of Equipment	Jan.-Sept., 1951 $ (000)
Electrical generators, motors, etc.	2,513
To Formosa	455
„ *Okinawa*	329
„ *Siam*	188
„ *Philippine Rep.*	129
„ *India*	648
„ *Pakistan*	503
Electric light bulbs and tubes	1,518
To United States	713
„ *Brazil*	70
„ *Belgium*	63
„ *Java*	55
„ *Formosa*	90
„ *Siam*	44
Radio apparatus	405
To United States	250
„ *Formosa*	88
„ *Siam*	24
Telephone and telegraph equipment	575
To Formosa	528
„ *Java*	17
„ *S. Korea*	29
Electro-thermic apparatus	63
To Venezuela	20
„ *Okinawa*	17
Electrical appliances for motor vehicles, etc.	51
To Formosa	24
„ *Singapore*	8
Electrical power apparatus	1,065
To Argentina	104
„ *Formosa*	466
„ *Okinawa*	171
„ *Siam*	65
„ *India*	48
Electrical cable and wire	1,565
To Formosa	786
„ *Okinawa*	430
„ *Philippine Rep.*	56
„ *Siam*	78
„ *Guam*	40
Other electrical machinery and appliances	2,342
To Formosa	348
„ *Siam*	171
„ *Philippine Rep.*	154
„ *Java*	119
„ *India*	633
„ *Australia*	371

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (2s 8d each including postage) will be obtainable after 9th April from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1944

16773. Farnsworth Television & Radio Corporation.—Radio receivers. 1st September, 1944. (669970.)

1945

4[illegible]. Telefonaktiebolaget. L. M. Ericsson.—Gaseous discharge tubes. 23rd February, 1945. (669971.)

26597. Eitel, W. W., and McCullough, J. A.—Electron tubes. 9th October, 1945. (669811.)

1946

35530. Donaldson, S.—Picture telegraphy apparatus. 22nd February, 1950. (669812.)

1947

191. Duke, S. M.—Electrical discharge apparatus. 2nd January, 1947. (669731.)

18003. Soc. Générale d'Applications Electro-Thermiques.—De-icing of railway permanent way installations. 8th July, 1947. (669976.)

23112. Ransburg, H. J., Ransburg, H. G., Ransburg, H. P., and Ransburg, E. M. (trading as Ransburg Co., H. J.).—Electrostatic coating method and apparatus. 20th August, 1947. (669978.)

26148. Westinghouse Electric International Co.—Electrical analysis of a physical system. 26th September 1947. (669814.)

29887. British Thomson-Houston Co., Ltd.—Automatic voltage regulating systems. 10th November, 1947. (669815.)

30696. Standard Telephones & Cables, Ltd. (Standard Telephones & Cables Pty., Ltd.).—Ionization manometer tubes. 19th November, 1947. (669631.)

35552. Compagnie Générale de Télégraphie sans Fil.—Radiation responsive apparatus. 31st December, 1947. (669632.)

1948

5960. Director of the Office of Technical Services, Department of Commerce.—Radio receivers and electrical circuits therefor. 27th February, 1948. (669634.)

5973. Magnetrons. 27th February, 1948. (669635.)

6982. Westaway, J.—Electric alarm devices. 6th April, 1949. (Cognate application 21259, 12th August, 1948.) (669820.)

9311. Standard Telephones & Cables, Ltd.—Dialling system for automatic telephony. 2nd April, 1948. (669822.)

14365. British Thomson-Houston Co., Ltd.—Tank type vacuum cleaners. 27th May, 1948. (669893.)

18249. Solomon, J. L.—Electric valve circuits for controlling the supply of alternating current to a load circuit. 7th July, 1948. (669637.)

20980. Benjamin Electric, Ltd. (Benjamin Electric Mfg. Co.).—Lighting fittings. 9th August, 1948. (669993.)

21103. Leich Electric Co.—Multi-contact switching device and circuit controlled thereby. 10th August, 1948. (669994.)

24998. Bendix Aviation Corporation.—Electric discharge tube. 24th September, 1948. (669640.)

25402. General Aniline & Film Corporation.—Electron-diffraction apparatus. 29th September, 1948. (669997.)

29635. Radio Corporation of America.—Directive antenna and arrangement for the use thereof. 15th November, 1948. (670001.)

30211. Hollister, F. L.—Electric current switches with magnetically controlled contacts. 21st November, 1949. (669642.)

31867. Concordia Electric Safety Lamp Co., Ltd.—Means for charging batteries. 9th January, 1950. (669643.)

32307. Westinghouse Electric International Co.—Gaseous electric discharge devices. 14th December, 1948. (670006.)

32832. Mallory Batteries, Ltd.—Alkaline electric dry cells. 20th December, 1948. (669833.)

33647. British Thomson-Houston Co., Ltd., and Thomas, D. T.—Automatic gain control systems. 9th December, 1949. (669834.)

33667. General Electric Co., Ltd., and Bryden, J. E.—Electrical signalling apparatus. 30th December, 1949. (670010.)

1949

268. Ellis, G. H. S. (Chapman Valve Manufacturing Co.).—Production of stainless steel in an arc electric furnace. 5th January, 1949. (670011.)

487. Centre National de la Recherche Scientifique.—Electrostatic machines. 7th January, 1949. (669645.)

986. British Thomson-Houston Co., Ltd.—Electromagnetic induction apparatus. 13th January, 1949. (670014.)

1259. Gowshall, B.—Illuminating devices for signs or the like. 18th January, 1950. (669897.)

1921. Compagnie Générale de Télégraphie sans Fil.—Ultra short wave switching. 24th January, 1949. (670016.)

3752. Electric & Musical Industries, Ltd.—Permanent magnet electron lenses. 6th February, 1950. (670020.)

4446. Pye, Ltd., and Court, P. R. J.—Beam centring devices for cathode-ray tubes. 20th February, 1950. (670021.)

4837. General Electric Co., Ltd., and King-Brewster, L. M.—High-frequency electric heating apparatus. 22nd February, 1950. (669841.)

4838 General Electric Co., Ltd., and Curtis, P. B.—High-frequency electric heating apparatus. 22nd February, 1950. (669842.)

4988. Marconi's Wireless Telegraph Co., Ltd.—Radio communication systems. 2nd February, 1950. (670023.)

5597. Woodhurst, H. (trading at Woodhurst Equipments).—Fuse wire holders. 1st March, 1950. (669904.)

5740. Radio Corporation of America.—Apparatus for amplifying a composite signal. 2nd March, 1949. (669647.)

7955. General Electric Co., Ltd.—Power presses. 24th April, 1950. (669754.)

8217. General Electric Co., Ltd., and Polgreen, G. R.—Electromagnetic transducers. 27th March, 1950. (670027.)

8965. Marconi's Wireless Telegraph Co., Ltd., and Walker, L. E. Q.—Apparatus for marking instrument scales. 22nd December, 1949. (670029.)

9133. Roulston, A. E.—Electrical calculating apparatus. 4th April, 1949. (670031.)

9405. General Electric Co., Ltd., McKeag, A. H., and Welch, E. E.—Electric discharge devices, in particular cathode-ray tubes, comprising luminescent screens. 4th April, 1950. (669848.)

9554. Electric & Musical Industries, Ltd.—Synchronizing of an induction motor. 27th March, 1950. (669849.)

9618. British Thomson-Houston Co., Ltd.—Dynamo-electric machines. 8th April, 1949. (670032.)

9636. Morgan Crucible Co., Ltd.—Method of connecting together electrical contact brushes of the same polarity. 3rd May, 1950. (669650.)

9783. Hewittic Soc. ARL.—Electronic motor control devices. 11th April, 1949. Cognate application 9784, 17th February, 1949. (669850.)

10478. Westinghouse Electric International Co.—Cathodes. 20th April, 1949. (669912.)

14013. Triggs, W. W. (Wyandotte Chemicals Corporation).—Electrolytic apparatus and process. 25th May, 1949. (669920.)

14811. Wadsworth & Sons, Ltd., W., Kerse, W. H., and Ryder, A. D.—Electric lifts or elevators. 30th May, 1950. (669924.)

14959. English Electric Co., Ltd.—Control systems for dynamo-electric machines. 26th May, 1950. (669854.)

16095. Radio Corporation of America.—Apparatus for determining the time interval between two time-spaced pulses in which said pulses are members of recurrent series having an equal recurrence rate. 16th June, 1949. (669856.)

16251. Ekco-Ensign Electric, Ltd., and Stickley, W. A.—Means for operating electric discharge lamps. 19th June, 1950. (669655.)

16358. Ramsey, A. R. J. (Mechanical Products, Inc.).—Electric overload protection switch. 20th June, 1949. (669656.)

16586. National Research Development Corporation.—Electronic storage apparatus. 1st June, 1950. (670042.)

16587. National Research Development Corporation.—Multi-stable-state valve circuits. 1st June, 1950. (670043.)

17814. Green, A.—Time-lag device for use with electric switches. 5th July, 1950. (669776.)

18275. Brown, C. R. B., and Brown, R. M. B.—Automatic control apparatus for electric motor driven pumps and sewage ejectors. 9th October, 1950. (669659.)

19368. English Electric Co., Ltd.—Compression distillation plant. 18th July, 1950. (669928.)

19369. English Electric Co., Ltd.—Electric motor control systems. 13th September, 1950. (670046.)

19101. British Telecommunications Research, Ltd., and Felix, M. O.—Crystal-controlled electric oscillation generators. 22nd June, 1950. (669863.)

19721. Chamberlain & Hookham, Ltd., and Deacon, L. O.—Electrical indicating or recording instruments. 4th July, 1950. (669865.)

20408, 20718 & 21637. Pyrotenax, Ltd.—Electric cables or other insulated electrical conductors. 24th and 27th July, and 4th August, 1950. (669779/1.)

21010. English Electric Co., Ltd.—Electric control systems. 11th August, 1950. (669869.)

21031. Babcock & Wilcox Co.—Device for recovering liquid carried in the gases evolved from electric storage batteries. 12th August, 1949. (670048.)

21172. Bayham, Ltd., and Hutchings, P. J.—Float-operated electric switches. 31st July, 1950. (669932.)

21298. Philips Electrical, Ltd.—Amplifying circuits embodying thermionic valves. 16th August, 1949. (669662.)

21993. Annacker, J. P.—Electrical distribution systems. 24th August, 1950. (669665.)

22114. Silto Soc. Anon.—Electric air heaters. 25th August, 1949. (669666.)

22116. British Thomson-Houston Co., Ltd.—Automatic electric circuit opening devices. 25th August, 1949. (670050.)

22802. United Insulator Co., Ltd., and Waye, B. E.—Ceramic dielectric materials. 23rd June, 1950. (669941.)

23094. General Electric Co., Ltd., Cooper, A. D., Nelson, E. H., and Willoughby, A. H.—Apparatus for producing repeated flashes of light from high-pressure gas or vapour-filled electric discharge lamps. 4th August, 1950. (669872.)

23855. Metropolitan-Vickers Electrical Co., Ltd.—Marine propulsion power plant. 14th September, 1950. (669945.)

24291. Hoover, Ltd.—Electric irons. 21st September, 1949. (669946.)

26718. Igranic Electric Co., Ltd.—Control circuits for discharge tubes. 18th October, 1949. (669953.)

26849. Hoover, Ltd.—Suction cleaners. 19th October, 1949. Cognate application 26850, 26th January, 1950. (669955.)

27818. Triggs, W. W. (Morgan Construction Co.).—Electrically driven rotary shears. 31st October, 1949. (669674.)

28182. Westinghouse Brake & Signal Co., Ltd., Stevens, S. A., and Watson, T. F. E.—Apparatus for the electrolytic prevention of corrosion of metallic underground structures. 12th September, 1950. (669675.)

28396. Santon, Ltd., and Sanders, J. C.—Electric liquid heaters. 6th November, 1950. (670059.)

28687. Muirhead, T. M., and Allott, G.—Electric storage batteries. 6th November, 1950. (670060.)

29868. Western Electric Co., Inc.—Cold-cathode gaseous electric discharge devices. 22nd November, 1949. (669679.)

29881. British Tabulating Machine Co., Ltd.—Electronic counters. 22nd November, 1949. (669962.)

30104. Ferranti, Ltd., and Heaps, J. G.—Electronic voltage stabilizers. 20th February, 1951. (669784.)

31666. Naamlooze Vennootschap Philips' Gloeilampenfabrieken.—Methods of re-magnetizing partly demagnetized permanent magnets in alternators. 9th December, 1950. (669686.)

31825. Westinghouse Electric International Co.—Automatic frequency control systems. 12th December, 1949. (669688.)

31828. Instrell, A. S.—Clips for securing electric conductors and other elongated members to a support. 1st December, 1950. (669689.)

31969. Cinema-Television, Ltd., and Sowerby, J. M.—Cathode-ray tube apparatus. 13th December, 1950. (669691.)

1950

125. Sperry Corporation.—Control systems for electric motors. 3rd January, 1950. (669696.)

1477. Radio Corporation of America.—Cascade-connected semi-conductor amplifiers. 19th January, 1950. (669702.)

2864. Philco Corporation.—Frequency modulation receivers. 3rd February, 1950. (669707.)

11541. Pye, Ltd.—Oscillatory circuits. 9th May, 1950. (669619.)

12450. Standard Telephones & Cables, Ltd.—Electri multi-channel pulse communication systems. 18th May, 1950. (669227.)

13433. Welwyn Electrical Laboratories, Ltd. (Soc. Elettrotecnica Chimica Italiana).—Connection clips for electrical circuit elements. 30th May, 1950. (669233.)

13727. Philips Electrical Industries, Ltd.—Electron-discharge tubes. 1st June, 1950. (669236.)

13863. Hoover, Ltd.—Switches in portable electric appliances. 2nd June, 1950. (669237.)

15607. Westinghouse Brake & Signal Co., Ltd., Jenkins, A., and Peter, L. H.—Manufacture of dry surface contact rectifiers. 22nd June, 1950. (Divided out of 669611.) (669622.)

18151. British Thomson-Houston Co., Ltd.—Seals for ultra-high-frequency transmission lines. 20th July, 1950. (669250.)

20284. Dow Chemical Co.—Electric primary cell. 15th August, 1950. (669256.)

20525. Sperry Corporation.—Radio tracking systems. 18th August, 1950. (669258.)

21233. British Thomson-Houston Co., Ltd.—Adjustable chain control mechanism. 28th August, 1950. (669262.)

21356. British Thomson-Houston Co., Ltd.—Capacitor winding machines. 29th August, 1950. (669264.)

21617. Philips Electrical Industries, Ltd.—Electric circuit arrangements for television camera tubes. 1st September, 1950. (669266.)

22974. British Thomson-Houston Co., Ltd.—Induction heating oscillator. 19th September, 1950. (669271.)

23444. British Thomson-Houston Co., Ltd.—Electric transformer. 25th September, 1950. (669273.)

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Australia. — MELBOURNE. — 26th March. Victorian Railway Commissioners. Supply of railway communication equipment. (C.R.E. 537/52. Ten/3615.)*

Brazil.—RIO GRANDE.—31st March. Servico Rio Grandino de Electricidade. Water tube boiler and feed pump. (C.R.E. 6753/52. Ten/3639.)*

Castle Ward (Northumberland).—12th March. R.D.C. Electrical installations in 92 houses at Ponteland. Surveyor, Council Offices, North Road, Ponteland.

Durham.—County Council. Electrical installation at Billingham New Technical College. (See this issue.)

Glamorgan.—Applications are invited from firms wishing to supply goods to and carry out services for the County Council. (See this issue.)

Gosforth.—19th March. U.D.C. Street lighting equipment. (See this issue.)

India. — BANGALORE. — 10th March. Stores Purchase Committee. Government of Mysore. Supply of 1,500 13.2-15 kV outdoor type porcelain bushings. (C.R.E. 6123/52. Ten/3617.)* 17th March. Supply of one 3,000 kVA outdoor unit substation, consisting of two 1,500 kVA transformers and one spare. (C.R.E. 6121/52. Ten/3626.)*

South Africa.—JOHANNESBURG.—6th March. Municipality. Supply of 72,000ft of steel cored aluminium conductor. (C.R.E. 6484/52. Ten/3621.)*

Uruguay. — MONTEVIDEO. — 27th March. Administracion General de las Usinas Electricas y Telefonos del Estado. Supply of 3,500 glass tubes for circuit breakers. (C.R.E. 5932/52. Ten/3627.)* 1st April. Earthing material. (C.R.E. 5934/52. Ten/3642.)* 4th April. Supply of 100,000 m of telephone cable and accessories. (C.R.E. 6535/52. Ten/3643.)*

ORDERS PLACED

Lowestoft.—Housing Committee. Electrical installations in 50 houses on Whitton estate (£1,196).—Eastern Electricity Board.

Manchester.—Housing Committee. Electrical installations in 31 houses on Bank House estate extension, Blackley.—E. M. Evans & Son, Ltd.

Middlesbrough. — Education Committee. Electrical installations at St. Paul's Mixed School (£298) and St. Paul's Infants' School (£329).—C. Horne & Co., Ltd. Electrical installation at Victoria Road School (£1,037).—A. Anderson & Sons.

Newcastle-on-Tyne. — Regional Hospital Board. Bed lift at West Hartlepool General Hospital (£1,470).—Austin Lifts, Ltd. Electrical installation at Dryburn Hospital tuberculosis unit (£836).—Veale Nixon, Ltd.

Northumberland.—County Council. Electrical installation in connection with conversion of "Springfield," Morpeth, into home for old people (£470).—J. & A. Oliver.

Wallasey.—Education Committee. Recommended. Electrical installation work at Park County Primary School (£1,563).—Merseyside & North Wales Electricity Board.

West Hartlepool.—Corporation. Electrical work in connection with proposed Brenda Road occupational therapy centre.—Heslop & Hall, Ltd.

CONTRACTS IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Adwick-le-Street.—Houses (220), Woodlands site; W. S. Ellis, surveyor, Council Offices, Adwick-le-Street, near Doncaster.

Ashton-under-Lyne. — Improvements to two blocks at Lakeside Institution (£48,500); county architect, Preston.

Barrow-in-Furness.—Extensions to central library and museum (£20,000); borough engineer.

Barton Stacey (Hants).—Houses (48); Y. J. Lovell & Son, Ltd., builders, Marsham Lane, Gerrards Cross.

Basford.—Houses at Calverton (156), Nuthall (140) and Kimberley (54) for R.D.C.; J. J. G. Ellis, surveyor, Rock House, Stockhill Lane, Basford, Nottingham.

Birmingham.—Flats (96), Great Francis Street; city engineer.

Blyth.—Houses (300); borough engineer.

Boston.—Dwellings (58); H. H. Adkins, builder, Edwin Street, Boston.

Bromley.—County primary school, Pickhurst Lane; borough surveyor, Municipal Buildings.

Bury.—Houses (82), Topping Fold estate; E. F. Davis, Ltd., Farnworth, Lancs.

*Specifications may be inspected at the Commercial Relations and Exports Department, Board of Trade, Horse Guards Avenue, Whitehall, S.W.1 (Trafalgar 8855).

Caernarvonshire.—Proposed new comprehensive school at Brynrefail; county architect.

Cardiff.—Primary school, North Llanishen; P. G. Budgen & Partners, architects, 95/97, St. Mary Street.

Carlisle.—Works extensions; J. K. Innes & Co., Ltd., Kingmoor Works, Kingmoor Road.

Flats (80); city engineer, 18, Fisher Street.

Chatham.—Houses (74), King George Road extension; C. J. Howard & Son, Ltd., builders, 272a, High Street.

Chesterfield.—Ante-natal and tuberculosis clinics at Scarsdale for Regional Hospital Board; Saxon, Snell, Son & Phillips, architects, 9, Bentwick Street, London, W.1.

Consett.—Houses at Gloucester Road, Ebchester, Hamsterley Colliery and Woodlands Road, Shotley Bridge for the U.D.C.; J. J. Eltringham, architect, Derwent Street, Blackhill, Co. Durham.

Dagenham. — R.C. secondary school (£170,150); county architect, County Hall, Chelmsford.

Darlington.—Houses (950) on new Branksome estate, Cockerton; borough architect.

Dewsbury.—Houses (232), Wakefield Road site; Harlow & Milner, Ltd., Warren Yard, Warrengate, Wakefield.

Dringhouses (Yorks). — First section of central college of further education, Ashfield (£95,725); William Birch & Sons, builders, York.

Gateshead.—Offices, Shipcote site (£99,000); Cussins (Contractors), Ltd., The Drive, Gosforth.

Grantham. — Extensions to medical and surgical units at Grantham and Kesteven General Hospital for Sheffield Regional Hospital Board; Lenton & Partners, architects, 16, Finkin Street, Grantham.

Great Yarmouth.—New Peterhouse junior school, Gorleston; F. Jackson, schools' architect, 15, Regent Street, Great Yarmouth.

Heanor.—Houses (52), Marlpool Farm estate; R. Archer, U.D.C. surveyor, Council Offices.

Hensingham.—Extensions to silk mills, for West Cumberland Industrial Development Co.; John Laing & Son, Ltd., builders, Carlisle.

Hereford.—Works, Holmer Road; Henry Wiggin & Co., Ltd., Crewe House, Curzon Street, W.1.

Keighley.—Houses (54), on two estates; E. G. Felgate, borough architect, College Street.

Lancashire.—Hostel for the aged, Golborne; and improvement works, etc., at Atherleigh Grange Institution, Leigh, together with new hostel for the aged; county architect, Fishergate Hill, Preston.

London. — DULWICH. — Flats (108), Croxted Road, for Camberwell B.C.; F. S. Palling, architect, 24, St. Mary Axe, E.C.3.

PADDINGTON.—Two four-storey blocks of flats, St. Philip's Place, W.2; W. H. Bentley, town clerk, Town Hall, W.2.

POPLAR.—Houses (44), Priory Street; borough engineer.

Longbenton.—Houses (300) for U.D.C.; A. E. Sweetman, surveyor, Council Offices, Forest Hall, Newcastle-on-Tyne.

Luton.—Factory, Crescent Road; Browne & Day, Ltd., cardboard box makers, Park Street.

Four blocks of flats, Richmond Hill and Collin Road; W. T. Sharpe, Ltd., 21, Woburn Street, Ampthill.

Maidstone.—Houses (52), on four sites; G. G. Letchford, clerk to R.D.C., 26, Tonbridge Road.

Morpeth.—Houses (28) at Lynemouth for R.D.C.; J. R. Miles, surveyor, Dacre Street.

Newcastle (Staffs).—Houses (22), Earls Drive estate; Baddeley Bros., Peel Street, Wolstanton.

North Riding.—School at Eston; Tasker & Child, architects, 25, New Bridge Street, Newcastle-on-Tyne.

Northumberland.—Child welfare centre at Morpeth (£10,500); J. Wilson, Ltd., builders, Oldgate, Morpeth.

Notts.—Conversion of Gedling Manor, Carlton, into home for aged persons; Mapperley Building Co., Ltd., 668, Woodborough Road, Nottingham.

Plymouth.—Dwellings (120), Ross Street and Pentamar Terrace; city architect.

Poole. — Houses (150), Waterloo estate; borough engineer.

Prudhoe.—Extensions at Prudhoe Hospital; Newcastle Regional Hospital Board, Osborne Road, Newcastle.

Sedgley.—Houses (30), Firs and Quarries sites; U.D.C. surveyor, The Limes, Dudley Road.

Smethwick.—Houses (202), Brandhall Road and Bleakhouse Road.

County primary schools at the Oval and near West End Avenue; E. L. Twycross, town clerk.

South Shields.—Block of shops at the corner of King Street and Market Place for Ravenseft Properties, Ltd.; L. H. Fewster & Partners, architects, 22, Conduit Street, London, W.1.

Houses (24), Mortimer Road; Henderson Brothers, builders, Smith Street.

Stalybridge.—Houses (32) and flats, St. George's site; P. W. Musther, town clerk.

Sunderland.—Houses (1,500); borough architect, Grange House, Stockton Road.

New Broadway County Primary Junior School for the E.C. (£70,000); A. V. Clerey & Son, builders, Frederick Street.

Sutton Coldfield.—Houses (40), Rosslyn Road, Warmley; Nuffield Metal Products, Ltd., Common Lane, Birmingham, 5.

Tunbridge Wells.—Dwellings (38), Sherwood estate; H. P. Bishop, borough surveyor.

Tynemouth.—Flats (24), Redburn View; J. H. Rogers, builder, Regent Terrace, North Shields.

Terrace houses on 12 sites; borough engineer, 16, Northumberland Square, North Shields.

Ulverston.—Houses (60), Croftlands Park, for U.D.C.; Baker & Foster, Ltd., Upper Brook Street, Ulverston.

Watford. — Houses (217), Kytes estate; borough engineer.

West Ham.—Factory, Bisson Street; British Cutting Gases, Ltd., 56, Lymington Road, N.W.6.